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Vol. XVI, No. 5
November, 1959

INDUSTRIAL QUALITY CONTROL

TOTAL QUALITY CONTROL IN A SMALL COMPANY

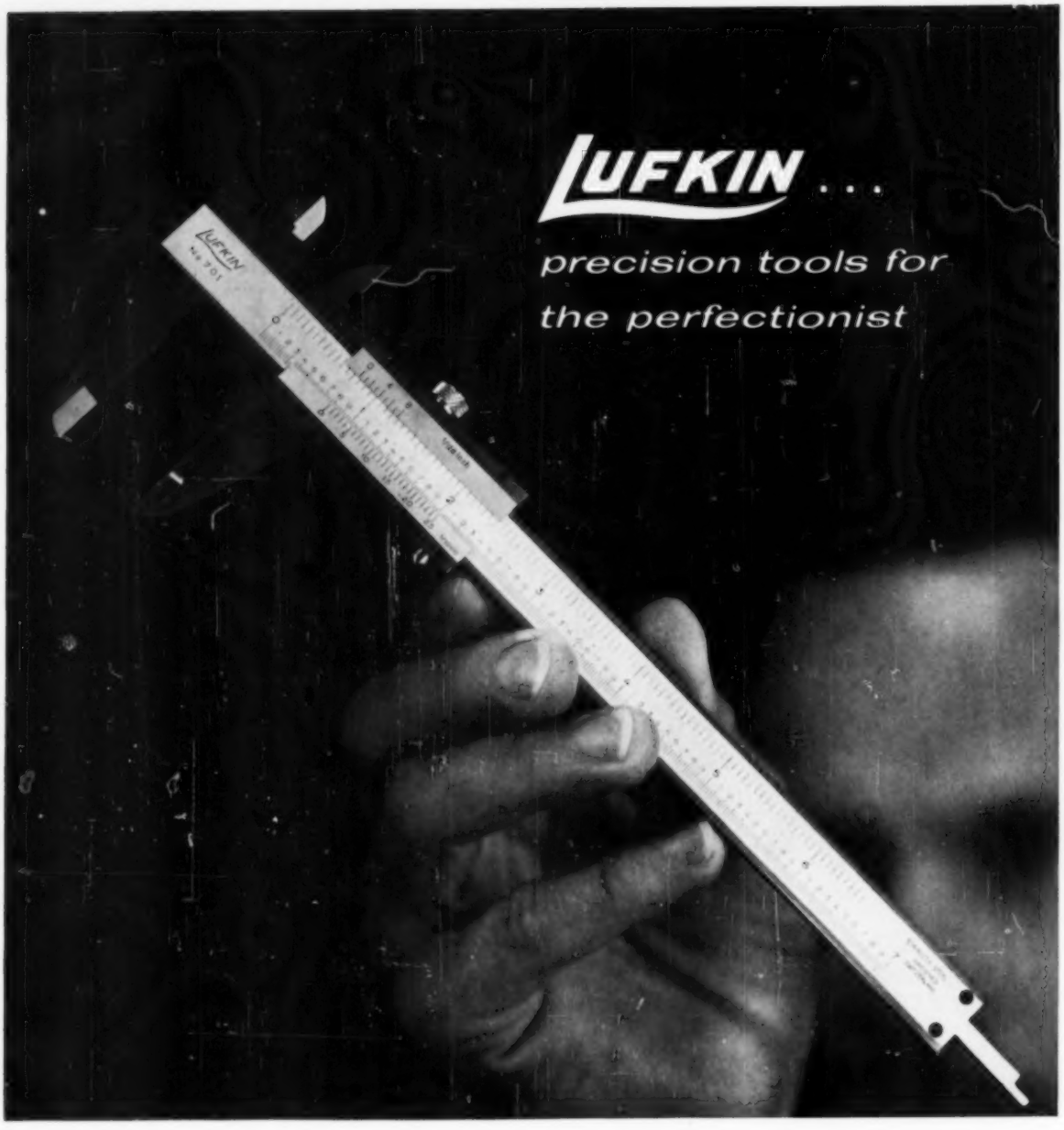
RESULTS OF QUALITY IMPROVEMENT

	1957 INCREASES	1958 REDUCTIONS
PREVENTION COSTS	$26,900	
APPRAISAL COSTS		$ 43,200
SCRAP AND REWORK		206,800
COMPLAINTS		53,600
TOTAL	$26,900	$303,600

SAVINGS $276,700

QUALITY through Scientific Methods

JOURNAL OF THE AMERICAN SOCIETY FOR QUALITY CONTROL



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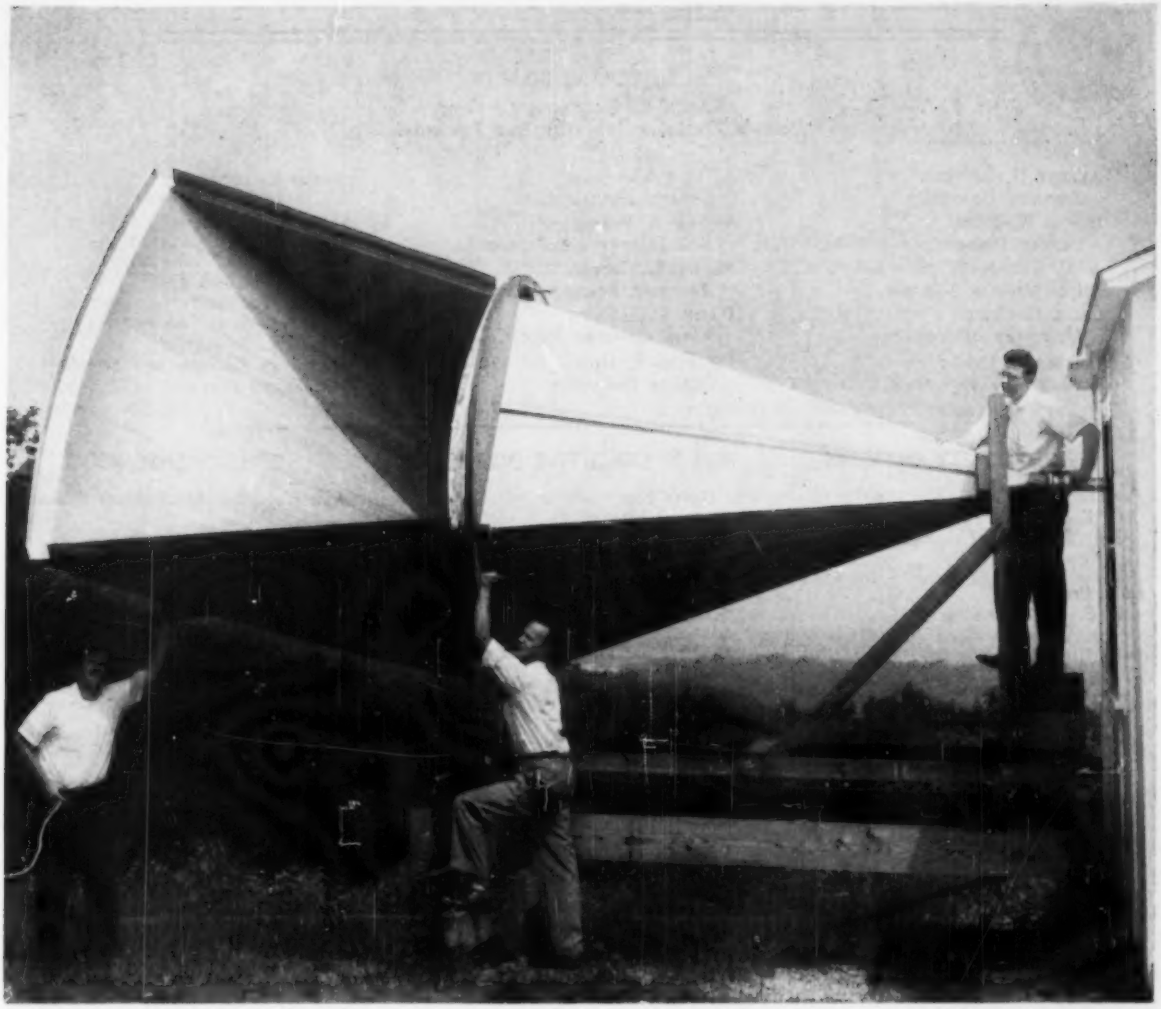

At Bell Laboratories, Holmdel, N. J., a horn reflector antenna is beamed skyward by scientists Edward Ohm, David Hogg and Robert DeGrasse. The maser amplifier, which employs a ruby cooled in liquid helium, is inside building at right. Over-all "noise" temperature of antenna, amplifier and sky is only 18°K at 5600 megacycles.

ANOTHER STEP TOWARD SPACE COMMUNICATIONS

The above antenna is part of a new ultra-sensitive radio receiving system under development at Bell Telephone Laboratories. It has extraordinary directivity. Beamed skyward, it ignores radio "noise" from the earth, yet picks up extremely weak signals from outer space.

The signals are amplified by the latest Bell Laboratories "maser" amplifier. The maser principle was first demonstrated, using gas, by Prof. C. H. Townes and his collaborators at Columbia University. Bell Laboratories scientists applied it to the solid state guided by a theoretical proposal of Prof. N. Bloembergen of Harvard University. Their latest traveling wave maser amplifier employs a ruby mounted in a waveguide. The ruby is excited to store energy. As signals pass through, they absorb this energy and are thus amplified. The device uniquely combines the characteristics needed for practical space communication: extremely low inherent noise and the ability to amplify a broad frequency band.

At present the receiving system is being used to pick up and measure minute radio noise generated by the atmosphere. It also foreshadows important advances in long distance communications. For example, it could extend the range of space-probe telemetering systems, could help make possible the transatlantic transmission of telephone and TV signals by bouncing them off balloon satellites—and has numerous applications in radio astronomy and radar.

This pioneer development in radio reception is one more example of the role Bell Laboratories plays in the pursuit of better communications technology.

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INDUSTRIAL QUALITY CONTROL

Vol. XVI, No. 5 November, 1959

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CHARLES A. BICKING **300:10:000**

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20 **A Rapid Method of Comparing Two Percentages**

J. H. FAIRFIELD **510; 552:60; 70:000**

When the characteristics of two lots fit specified assumptions, a comparison for a significant difference can be made very quickly with a nomograph presented by the author. For example, consider two lots of 5000 condensers offered to a radio manufacturer. A sample of 100 from lot 1 and 200 from lot 2 are tested for breakdown voltage, revealing 10 and 30 defectives respectively. Which lot should be purchased?

22 **Professional Quality Control Engineering**

A. V. FEIGENBAUM **000:00:000**

The true professional nature of Quality Control Engineering remains one of the least understood and, therefore, one of the least fully practiced technical activities in America today. It is our purpose in this paper to focus attention on the true character of our work.

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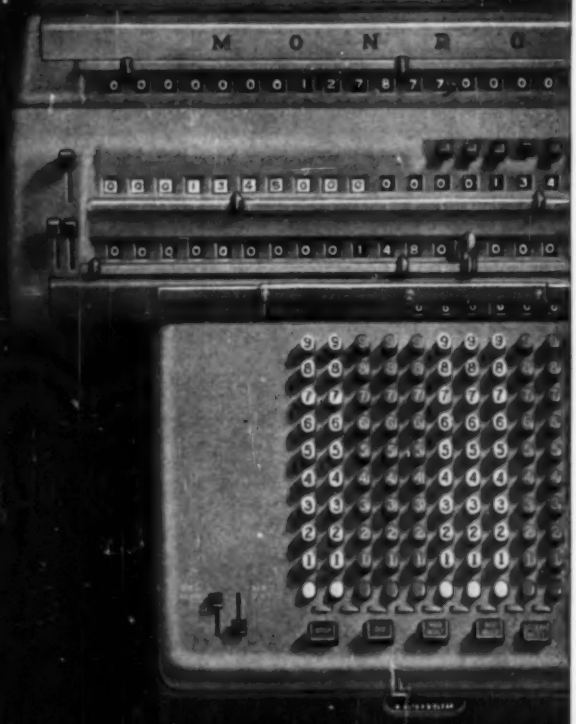

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THE TEAM APPROACH
In Quality Control Investigations

CHARLES A. BICKING

The Carborundum Company, Niagara Falls, N. Y.

Introduction

Eighty-eight percent of the articles published in *Industrial Quality Control* have one author, ten percent have dual authorship, and only an unimpressive two percent have more than two authors.* This might be taken as an indication that quality control is a lone-wolf operation. There well may be some basis for this inference because in the early days, in particular, a torch was being carried by lone individuals in many an organization and the very existence of a quality control activity was due to their missionary zeal. Even now, formally organized quality control departments employing more than a very few engineers, even in large organizations, are not the rule. Although the educational activities sponsored and encouraged by the American Society for Quality Control have reached tens of thousands of people in industry, many are constrained to apply the techniques as a part-time assignment and without formal organizational recognition of their quality control function. In spite of the dependence on individual initiative, however, the team approach has been used for a long time.

The margin between failure or success in many instances has been the degree to which there was teamwork between the quality control engineer, the research and design engineers, and production personnel. Relatively little has been published about the team approach, so that one might conclude that it was a fortuitous rather than a planned use of the team idea on the part of those who succeeded.

In a somewhat newer management technique, Operations Research, the concept of the team is one of the essential characteristics. There are so many similarities between the conduct of operations research and quality control that it seems desirable that more light be shed on the part teamwork has to play in the latter technique.

ASQC LCS Code 300:10:000

*Immediate source of information: Ervin F. Taylor in a tentative proposal of the Bibliography Committee, ASQC, for a bibliography service, February 1957.

The Essential Characteristics of a Team

A successful team is remarkable on several counts. It should bring together a number of people, each of whom has something different to contribute to the solution of a problem. As an individual, each member of the team has something special to contribute to the success of a job. Mutual respect and recognition of the talent and special attributes of the other members provide a basis for effective cooperation. The work of the team is so organized that the various members look at the same phases of each problem from a different point of view.

In order to be recognizable as a team, the group working together must have a common goal. The members must have a willingness to cooperate. It helps if they have had earlier mutual experiences, but since there has to be a beginning, even a group of strangers can be welded into a team under the right conditions. A cardinal condition is that each one recognize that no one is competing in another man's territory.

Good members of a team must be willing to try new combinations of ideas and things and to accept new approaches or attitudes. There must be a willingness to accept the initiative in following up on plans agreed upon by the team. Each man must be able to work under self-direction after a general outline has been agreed upon.

Cooperation must be just as strong at planning stages as at stages of execution or evaluation of a plan. Members of the team must be able to take and give constructive criticism impartially. Each must have the ability to accept compromise; to agree on definitions, on the setting of schedules, and on the necessary limitation of individual activity. A mark of a good team worker is a willingness to share fairly the credit for a task well done.

These characteristics are just as important whether the teamwork has come about naturally and artlessly or whether it has been the result of a coordinated plan.

With the advent of professional teams in the consulting field as well as on the staffs of large manufacturing organizations, some additional general characteristics have become recognizable. Such teams need the support of top management and considerable freedom of action. The level of maturity and professional ability is very high. Work of great responsibility is attractive to capable people. The members of these teams are hand-picked. Because of the respect that they command, the team often has much influence and can evoke the authority to act when necessary. The very air of authority and assurance makes accomplishment of difficult tasks possible.

There is great moral as well as technical force behind a team that has a systematic program. There is a great advantage in having a system for assignment of responsibility for action and in maintaining a strict check-off as action is taken. Experience has led to the breaking down of complex projects into parts of manageable size and to the assigning of each part to a specially qualified team, often of not more than three to six men.

It may be instructive to recall some examples of application of the foregoing principles from past experiences which in retrospect appear to have been characterized by good teamwork, to describe the exceptionally productive teamwork between Army Ordnance and the Bell Telephone Laboratories during and since the Korean War, and to present some current developments in the team approach in process quality control.

Artless Uses of the Team Approach

Teamwork on a Pilot Plant Problem

A number of years ago, the general management of a chemical company was providing a new and specialized advisory service to the plants in the form of assistance in the introduction of statistical methods of quality control. The quality control staff had recognized, however, that in the chemical industry the study of analytical precision and the statistical design of experimental work should accompany or precede attempts toward process control. The company quality control engineer was therefore spending some time at a plant laboratory in order to induce chemists and development engineers to expand their use of statistical methods.

Also at the plant at the time was a staff process engineer who was working with one of the project development chemists in the laboratory on a pilot plant operation. At the suggestion of the project engineer, the process engineer and the quality control engineer met with him at the laboratory one morning to discuss the possibility of a chart method for control of the pilot plant. The three men had known each other for some time. The two from the home office staff, although they did not ordinarily work as a team, both had considerable experience in helping solve production problems and both had expressed willingness to work together with interested project engineers on current development problems. This team met only once for a brief time in connection with the problem mentioned and thereafter carried out a plan and achieved results very rapidly. The details of the plan have been published[1] and need not be repeated here. However, a brief description of the method of operation is essential.

Data already at hand were used almost exclusively. A scatter diagram for the percent conversion against one of the control characteristics was made using results of a special run. The resulting scatter confirmed what was known about the reaction. A curve was fitted to the plotted points and plus and minus limits were drawn about the curve so that 95 percent of single determinations should lie within them if proper processing conditions were being maintained. Operators were instructed to raise or lower temperatures depending on position of each routine test with respect to the control limits. They found the method was much easier and quicker than the former tedious method of control. The project engineer began to experiment with different temperatures, pumping rates, frequencies of catalyst change, and numbers and arrangements of reactor vessels. It was soon discovered that best conditions were produced by using the reactor with fresh catalyst ahead of the reactor with partially spent catalyst, in contradiction of accepted procedures. It was estimated that the results were achieved six months earlier than would otherwise have been possible and that the total cost saving was ten percent.

One might speculate on what elements in this situation caused it to be remembered as so remarkable. It may be simply that all the essential conditions for successful teamwork were fully satisfied.

Teamwork on a Plant Process Problem

Another example of teamwork dating back to the early days of statistical quality control in chemical processes has been described recently.[2] This has to do with the introduction of control charts for the first time in a plant where supervision had almost no prior experience with statistical methods. The staff quality control engineer traveled to the plant. He met with the plant superintendent, the control chemist, and a development chemist to discuss what should be done. During a two day visit, this team reviewed preliminary charts showing prior data plotted between specification limits, studied the process to select appropriate control points, and outlined a control chart program for three processes and a precision determination program for the principal chemical analyses involved.

During succeeding months, the members of the team permanently stationed at the plant worked steadily on achieving process control with occasional advice from the quality control engineer. Within two months, the control laboratory had made replicate tests on homogeneous samples to arrive at precision figures for all the principal control tests. Control charts began to show a steady improvement in uniformity. For one process, the control chart was of assistance in locating an error in calibration of the feed tank for a raw material. Correction of this defect led to greater ease in handling the process and greater uniformity in product.

At the end of the first six months the uniformity of the various characteristics of one product had been improved by as much as 54 percent with an accompanying reduction of 6½ percent in processing time. For another product, uniformity of one characteristic improved 60 percent and other characteristics were being brought into control. A third product was so much improved that it was possible to produce a USP grade within specifications 100 percent of the time.

Credit was consistently given to the fine teamwork on the part of the group put together at the plant to handle this project and their fine cooperation with the quality control engineer.

Teamwork on an Industry-wide Basis

On occasion, our industrial system gives rise to opportunities for team collaboration of an unusual sort. An example is an informal team that had a considerable impact on the acceptance of statistical quality control in the pulp and paper industry.* These three men—a research chemist, a technical service engineer, and a quality control engineer—collaborated over a period of years. All were employees of the same company but were in different divisions. After assignment to a common project brought them together, they continued to collaborate on a spontaneous basis.

This collaboration consisted of educational activities within the plants and laboratories of the company and in the plants of customers. It involved the planning, conduct, and analysis of mill trials of company products. It involved introduction of quality control techniques to the plants of the company and of experimental techniques to its laboratories. It involved work on the Statistical Committee of the Technical Association of the Pulp and Paper Industry. It involved the preparation of bibliographies and the distribution of technical material on quality control. It involved personal selling of quality control principles on many private and social occasions. It involved mutual review and criticism of plans, analyses, and reports of testing. It involved publication of significant contributions to the literature. It involved collaboration in teaching short courses under the auspices of the Technical Association.

The feeling of identity of interests, a high mutual regard for each other's various talents, and an unselfish, almost disinterested sharing of credit led to results none of the three could have achieved alone.

Teamwork Perfected for National Defense

Quality Control of 105 mm. Ammunition

The tremendous job done for Army Ordnance during the Korean War by the Quality Assurance Department of the Bell Telephone Laboratories is well known.[3] The project for quality control of 105 mm. complete rounds resulted in successful production of an initial large lot of over 149,000 rounds within which the dispersions of muzzle velocity and range were fully as low as for the very much smaller

*Team members were: Richard T. Trelfa, a Fellow of ASQC, now director, technical services, Perkins Goodwin Co.; Harris Ware, now manager of technical service, Beveridge Paper Co.; and the author. All were then employees of the Hercules Powder Co.

lots, of the order of 30,000 rounds,* produced prior to the beginning of the project.

What has not been so well publicized is the fact that the success was due to the remarkable teamwork that existed between Bell Laboratories and Ordnance personnel. In the words of George D. Edwards, project engineer for Bell Laboratories:

> "During a considerable part of World War I and throughout practically the whole of World War II, I worked with various branches of the armed forces in a capacity somewhat similar to the one in which I now find myself. Never before have I experienced the sort of cooperation, and the genuine desire and ability to cut red tape, and to do everything possible to forward the job, that the Ordnance Ammunition Center has shown."

This teamwork was the result of a new concept in organization. The contract called for Bell Laboratories to provide a skeleton organization of quality control engineers and for Ordnance to parallel this with an organization of "opposite numbers" in each case. There were two reasons put forward for this provision: first, to keep the cost of the contract as low as possible; and second, to train Ordnance personnel as rapidly as possible, so that they could take over full responsibility for the work at the earliest possible moment. Actually, the "opposite number" concept evolved as an extremely valuable organizational principle, and has been applied successfully to later Bell Laboratories-Army Ordnance projects and is being used successfully in industry.

Throughout the 105 mm. project the team was favored with constant help and cooperation of the regular Ordnance supervisors and personnel as consultants, advisers, and as instructors in ballistics to Bell Laboratories engineers. Also, Ordnance contractor personnel from American Safety Razor, Chevrolet Shell, General American Transportation, Goodyear Engineering, Kelsey-Hayes Wheel, Malleable Iron Range, and Thor Corporation, were most helpful at all times.

Quoting Mr. Edwards again,

> "Process quality control is frequently an elusive sort of thing. We (the Bell Laboratories members of the team) have certain standard tools, such as control charts, analysis of variance, etc., which we can apply. But if none of them work, we still have to get the answer, and we are forced to fall back on 'ingenious devices' for doing so. That is when Ordnance knowledge and experience are able to make a very special contribution to the job."

*Lot sizes were commonly much smaller than this during World War II, being then of the order of 3000-4000 rounds. Ordinary quality control techniques had increased the lot size to about 30,000 before Korea.

Quality Assurance for the Nike Missile

This use of opposite numbers worked out so very well that when, in 1954, Bell Laboratories undertook the assignment of developing quality assurance procedures for the Nike I guided missile, it was again included as a contractual requirement.[4] Although the far-flung organization required to cope with a production effort of the size of this one made difficult the keeping of an effective team in the field, a major effort was made throughout the contract to maintain the balance of 'opposite numbers' on the team. This effort was fully vindicated.

Another excellent example of the use of the team approach, although not new,* was the practice of using the committee technique in making quality surveys of various components and sub-assemblies of the missile. The Survey Committee usually consisted of three members, authorized to represent respectively the quality assurance agency, the inspection agency, and the supplier. For example the first quality survey on the Nike Project involved the ballistic test of the booster. The committee consisted of a Bell Laboratories quality control engineer, and his Ordnance "opposite number" from the project office (for the Quality Assurance Agency), an engineer from the plant manufacturing the booster (for the supplier) and the Ordnance resident inspector from the plant (for the inspection agency).

The operation of a quality survey committee has been described by E. G. D. Paterson, who supervised the Nike Quality Assurance Project.[5]

Each member of a survey committee was responsible for those factors affecting quality which were within his purview. For convenience, the subject areas were divided as follows:

A. Quality Assurance Agency
   1. Contracts, specifications and drawings
   2. Examination of a sample of current product
   3. Inspection procedures
   4. Inspection results and surveillance results
   5. Service complaints
   6. Review of quality standards

B. Inspection Agency
   1. Inspection procedures
   2. Gage and test set calibration and records
   3. Service complaints

C. Supplier
   1. Manufacturing drawings, handbooks, and layouts
   2. Manufacturing facilities, including gages and test sets
   3. Manufacturing inspection procedures
   4. Manufacturing difficulties
   5. Raw materials inspection

The committee survey technique as used by the Bell Laboratories has an impressive record of success.

*A quality survey procedure employing a committee or team approach had been in successful operation in the Bell Telephone System for over 25 years.

Artful Use of the Team Approach

In a recent paper,[6] General Leslie E. Simon suggested that, particularly if operations are large or complex, launching of a statistical quality control program "can be done most economically by assembling a crew of experts to design, install and initially operate the SQC system." He suggested, also, that "concurrently, 'opposite numbers' drawn from existing personnel or obtained by recruitment, must be assigned to training so that they can take over the operation from the experts."

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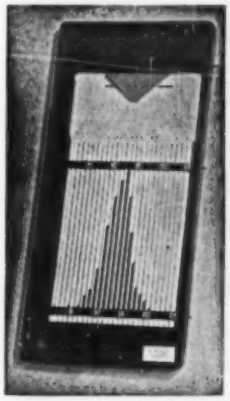

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Continuing to quote General Simon,

> "The installers of a quality control system must secure teamwork between themselves and operating personnel to devise alterations in process and in-process inspection for the purpose of bringing each stage of the process to a state where it will respond to statistical control. It is very important that the installers of SQC and the permanent personnel be friends.
>
> "The exercise of ingenuity both in statistics and in engineering is necessary to bring a process under statistical control. Changes must be made in the flow of product so that each increment arising from a different source can be checked for quality before it is allowed to mix and lose its identity. New inspection points must be set up for each check point. The most knowledgeable people associated with the process must be brought together to seek out causes for lack of control and devise ways and means for their elimination."

This is the general concept of staff quality control organization now being carried out at The Carborundum Company. In the early stages, the size of the team has been variable both because new members of the quality control group have been in training and because some missionary work had to be done before operating divisions could see the problem clearly enough to make permanent assignments to the team. Eventually, it is expected that each study involving a major process will call for a team of perhaps three members of the quality control staff; a senior quality control engineer plus two junior engineers or quality control technicians. It is expected that operations will appoint two or three engineers or technicians to each team.

The senior engineer is captain of the team and is responsible for all phases of planning and execution of the program for the assigned process. Assisted by members of his team he makes a verbal report of progress at frequent staff meetings. He organizes a brief, factual progress report at the end of each month. This is combined with other team reports in a report by the Quality Control Manager to the Vice President in charge of Research and Development. The team captain, or the responsible members of his team, write technical reports including conclusions and recommendations, at the completion of each major phase of the program. These reports are checked with the operating division members of the team and with operating supervision and are issued jointly. Appropriate actions are assigned either to the Quality Control Branch or to the Operating Department. At the completion of the study of a process, a final report or reports are written and the process control system established is turned over to the cooperating division for routine operation. The concept calls for routine surveillance of each completed program to assure its continued effectiveness.

Conclusion

Several types of team approach to a statistical quality control program have been mentioned:

1. The most frequent approach is the one in which the individual assumes the initiative for interdepartmental cooperation. A one-man quality control department must use this approach or be relegated to an obscure niche in the organization.
2. The use of 'opposite numbers' in a team made up more or less equally from a consulting, or staff group, and an operating group. This has been very useful in stepping up effort on particular programs and carrying them most rapidly to conclusions.
3. The conscious effort to exploit the team approach in the operation of a staff quality control function in a multi-division manufacturing organization. This promises to maximize the real benefits of quality control both in breadth and depth.

There are some difficulties involved in the successful use of teams that are formally organized and strictly assigned to a project, particularly if the project is of limited duration. First, it is difficult to put together a team if the future of the assignment is not completely clear. Individuals may be doubtful about what happens upon completion of the project. On the Bell Laboratories-Ordnance projects, difficulty was experienced in inducing people to move to a location geographically distant from home base on a temporary and even uncertain basis. This was more difficult when Ordnance people were moved to the Laboratories to take part in the Nike project than when the Laboratories moved some of its staff to the Ordnance Ammunition Center for the 105 mm. project. Both of these projects had the additional disadvantage that the production operations concerned were scattered throughout the country.

Second, there is difficulty in finding suitable people in operating divisions to assign to the teams. Usually, available people also have routine duties which either must be neglected or temporarily reassigned.

Third, there is a pedagogical problem in training someone from the operating group to take over the procedures when the team completes its work and pulls out.

1959 Shewhart Medal Nominations

Nominations are now being received by the Shewhart Medal Committee for consideration with respect to the 1959 Shewhart Medal Award. Previous Medalists are:

L. E. Simon	—1948	E. G. Olds	—1954
H. F. Dodge	—1949	W. E. Deming	—1955
M. A. Brumbaugh	—1950	M. E. Wescott	—1956
G. D. Edwards	—1951	C. C. Craig	—1957
E. L. Grant	—1952	I. W. Burr	—1958
H. G. Romig	—1953		

A letter of notification is being sent to all ASQC Section Chairmen. Any member of the Society is privileged to make a nomination for this honor. It is important, however, that any nomination be accompanied by suitable biographical and other information supporting the nomination so that the Committee will be able to give adequate consideration to the qualifications of the nominee.

Nominations may be forwarded to the Shewhart Medal Committee through the Chairman of the local Section, or they may be sent direct with supporting information (10 copies, please) to the Chairman of the Medal Committee, Edwin G. Olds, Department of Mathematics, Carnegie Institute of Technology, Pittsburgh 13, Pa. Nominations received by the Medal Committee on or before December 31, 1959, will receive due consideration.

Finally, the problem of communications is accentuated when large numbers of people are directly involved in a project.

These disadvantages are more than offset, however, by the many advantages of the team approach. Once communication is established, results are achieved much faster than otherwise would be possible. Industrial relations are improved by the feeling of belonging to the team.

The use of the term 'opposite numbers' is anomalous because exactly the reverse of opposition is implied by teamwork. Perhaps an improvement could be made by referring to the team as made up of "complementary members" from the quality control staff and the operating division.

Another point in favor of the team is that experience has demonstrated that the team method is the most effective way of operating quality control as a staff service.

Perhaps the greatest advantage of all, lies in the fact that once a quality control system has been agreed upon and put in operation it has a greater likelihood of sticking since those most closely concerned, the operating people themselves, have had a part in the whole endeavor.

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(2) "Quality Control in the Chemical Industry," Charles A. Bicking, *Proceedings Fourth Annual Forum,* Toronto Section, ASQC, Toronto, March 9, 1957

(3) *Minutes of Progress Review Conferences, Quality Control 105 mm. Complete Round,* Bell Telephone Laboratories, 1951-52

(4) *Minutes of Progress Review Conferences, Quality Assurance Nike I Round* (Unclassified), Bell Telephone Laboratories, 1954-56

(5) "An Over-all Quality Assurance Plan," E. G. D. Paterson, *Industrial Quality Control,* Vol. XII, No. 11, May 1956, p. 32-37

(6) "Initiating a Quality Control Group in an Existing Organization," Leslie E. Simon, *Industrial Quality Control,* Vol. XIII, No. 11, May 1957, p. 24-29

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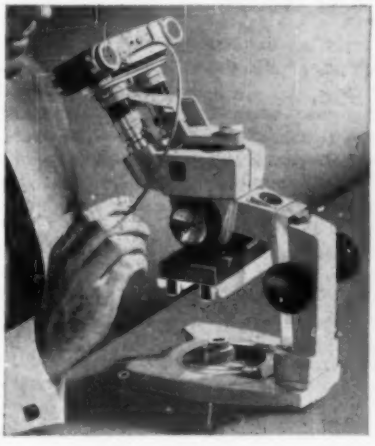

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STOPPING RULES

With CSP-1 Sampling Inspection Plans

In Continuous Production

R. B. MURPHY
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Summary

A technique for selecting a CSP-1 sampling inspection plan for attributes is proposed and illustrated. On the basis of a comparative study, a kind of stopping rule Rule (r)—to accompany such a plan is chosen and Table V and equation (6) are presented to assist in selecting the parameter r.

Introduction

In continuous production changes in quality can occur suddenly and may require prompt action to avoid wasting materials or labor. There has been considerable interest recently in providing criteria based on inspection data to determine when such action should be taken.

These criteria have been called stopping rules because in some applications it may be justifiable to stop the manufacturing process in order to correct the condition. In general, the kind of action taken would depend on the nature of the application and might not necessarily involve the stopping of production, but the term "stopping rule" is a convenient one in any case.

This article concerns the application of such stopping rules to Dodge's CSP-1 sampling inspection plan for attributes.† In this plan the inspection procedure begins with screening units of product as they are produced. Such a sequence of units may be called a screening sequence. The sequence ends as soon as an uninterrupted run of a specified number, i, of nondefective units has been found. Then a specified proportion, f, of the output is sampled for inspection in a way to insure a random sample. Depending on the circumstances, this sampling may be of systematic, block, or probability type.‡ When a defective unit is found in sampling, a new screening sequence starts, and the above procedure is repeated. It is often recommended that the producing shop be responsible for screening required by the plan.

Presented at the 12th Annual Convention, ASQC, Boston, Mass., May 1958.

†The term CSP-1 was introduced in *Ref.* (3), but the term "random-order plan" was used in Ref. (2). References (1) and (2) contain more complete information on CSP-1 than does *Ref.* (3).

‡With reference to CSP-1 plans, these terms mean—
Systematic sampling: Inspect every $1/f^{th}$ unit produced;
Block sampling: Inspect a randomly chosen unit from each successive block (or "lot") of $1/f$ units produced;
Probability sampling: Inspect randomly selected units so that f is the over-all average frequency of inspected units.

ASQC LCS Code 224:70:400

One object of this article is to investigate statistical characteristics of stopping rules from the viewpoint of a manufacturer who follows a CSP-1 plan to help assure outgoing quality to his customers and who wishes to use a stopping rule based on inspection results as an aid in controlling quality. Such a manufacturer would not, of course, want a stopping rule of this kind invoked more often than any "hunt-for-trouble" rules employed in more direct process controls.

Another object is to present some useful results of this investigation so that they may be applied. Specifically, these results include a method of choosing a CSP-1 plan in the first place and then a method of specifying a stopping rule, known as Rule (r), which is recommended for the situation considered here. In choosing results which might prove useful, the author considered the practical aspects of inspection engineering and operation as far as possible.

The next section is intended for purposes of application. The more theoretical sections follow it. A summary of notation and formulas is given in Tables II and IV, while Table I defines the stopping rules, the statistical characteristics of which have been studied. The purpose of the other tables will be discussed later.

Application

Choosing a CSP-1 Plan

We now take up the problem of choosing a CSP-1 plan from the point of view of a manufacturer who wishes to guarantee a certain level of quality of output and to use his final inspection procedure, assumed to be based on a CSP-1 type of attributes inspection plan, as an aid in controlling production.

TABLE I—Stopping Rules for CSP-1 Plans

Rule $(n^* - 1)$	Stop as soon as a defective unit is found in any one screening sequence after the sequence has exceeded $n^* - 1$ units.
Rule (r)	Stop as soon as a specified number r of defective units are found in any one screening sequence.
Rule (N,R)	Stop as soon as a specified number R of defective units are found in any block of a specified number N of inspected units. (Blocks do not overlap.)
Rule (n^*)	Stop as soon as a specified number n^* of units have been inspected in any one screening sequence without ending it.

TABLE II—Definitions and Notations

p =	The probability that a defective unit is produced = process average
q =	$1 - p$
i =	The number of nondefective units produced and inspected in a row before sampling may be used
f =	The average fraction of output inspected when sampling is used.
F =	The total fraction of units inspected
AOQL =	100A = Average Outgoing Quality Limit, the maximum of the average quality of outgoing product for all possible process averages (in percent)
PNQL =	P = Producer's Nominal Quality Level, a value of p chosen with the AOQL and F to fix f and i
T_n =	The probability that no run of i nondefective units has occurred by the time n units have been produced. (NOTE: For brevity the expression for T_n is omitted.)
k =	$(1 - T_{n^*})/(1 - q^i T_{n^*} - T_{n^*+1}) =$ Correction factor for characteristics of Rule (n^*). (See Table IV.)
D_r =	$(1 - q^i)^r$ = The probability that no run of i nondefective units has occurred by the time r defective units have been produced
$B_n(x)$ =	$\sum_{m=x}^{n} \binom{n}{m} p^m q^{n-m}$ = The probability that no more than n units have been produced by the time x defective units have been produced
Stopping cycle =	The elapsed production period from one time a given stopping rule is invoked until the next time it is invoked
Counting cycle =	The elapsed production period from one time defectives begin to be counted until the next time they begin to be counted in accordance with a given stopping rule. [Applies only to Rules (r) and (N,R)]
m =	The (variable) number of units produced in a stopping cycle
m_c =	The (variable) number of units inspected in a counting cycle
$E(m)$ =	The average of m (= E at the PNQL)
$E(m_c)$ =	The average of m_c

First, the manufacturer should choose an AOQL in keeping with his own and his customer's wishes. In Dodge's articles[1, 2] a chart is presented showing the variety of f and i plans which are associated with an assigned AOQL. Over a range of values of f and i, there is a single value of i corresponding to any specified value of f (and vice versa) associated with the assigned AOQL. Therefore, another specification beside AOQL is required to determine f and i uniquely. We propose as a second restriction a choice of the total fraction of units inspected (in both sampling and screening) at a value of process average chosen by the producer and called the *Producer's Nominal Quality Level* (PNQL).¶ Ordinarily the PNQL would be a fraction of the AOQL representing a value of process average at which the producer would be satisfied to operate but which is neither a limiting level nor necessarily a target level. Finally the total fraction of units inspected, F, at the PNQL is chosen.†

For a given combination of values of AOQL, PNQL, and F that would usually be considered reasonable, there is one, and only one, CSP-1 plan satisfying this combination precisely. Of course, i must be an integer, and it may be convenient to round the values of f and i so that the plan settled upon may have values of AOQL and F at the PNQL satisfying the original combination only approximately. For purposes of illustration we have chosen 5 percent and 1 percent AOQL's, 0.10 and 0.25 for F, and PNQL's expressed as fractions equal to one-half the AOQL's. We thus obtain four illustrative plans, a unique one for each combination of AOQL and F (see Table III).

¶The author is indebted to H. F. Dodge for this term.

†An almost identical principle for selecting f and i appeared independently while work on this method was in progress. See Guthrie and Johns.[4]

The technique of finding a specific CSP-1 plan (f and i) on the basis of the above kind of specification can be illustrated in the case AOQL = 1 percent, PNQL = 0.005, and F = 0.10 (see Table III). It will be convenient to abbreviate PNQL by P and the AOQL, expressed as a fraction, by A.

If $A > P$,

$$\frac{(1-F)\ (1-A)}{AF} > e = 2.718\ \ldots \qquad (1)$$

we may be assured that there is a CSP-1 plan approximately satisfying the given specification. In the illustration, $A > P$ and the left side of the second inequality in (1) above is 891, and so we are certain to find a plan. Then we compute

$$a = \frac{(1-F)\ (1-P)}{AFe}$$

$$b = -\ln\left(\frac{1-A}{1-P}\right) \qquad (2)$$

$$c_0 = ab/(1+ab)$$

In our example $a = 329.5$, $b = 0.00504$, $c_0 = 0.624$. We calculate

$$c_1 = \frac{1 + c_0}{1 + e^{c_0}/ab} = 0.765$$

$$c_1/b = 151.8$$

$$d_1 = a/e^{c_1} = 153.3$$

The desired value of i lies between the integral parts of the last two figures. Thus $151 \leq i \leq 153$. For simplicity we round to 150. (See Table III.) In general, we compute

$$c_n = \frac{1 + c_{n-1}}{1 + e^{c_{n-1}}/ab},$$

$$c_n/b, \qquad (3)$$

$$d_n = a/e^{c_n}$$

The proper value of i lies between the integral parts of c_n/b and d_n, or in the usual notation

$$[c_n/b] \leq i \leq [d_n] \qquad (4)$$

In every case $c_n > c_{n-1}$.

TABLE III—Illustrative CSP-1 Plans and Stopping Rules

Specified				
AOQL	1%	1%	5%	5%
PNQL	0.005	0.005	0.025	0.025
F at PNQL	0.10	0.25	0.10	0.25
E	10^4	10^4	10^4	10^4
CSP-1 Plan				
i	150	70	30	15
f	0.05	0.20	0.05	0.20
Actual				
AOQL	1%	1%	4.8%	4.6%
PNQL	0.005	0.005	0.025	0.025
F at PNQL	0.1004	0.2620	0.1011	0.2677
Rule $(n^* - i)$				
n^*	251	127	79	36
$n^* - i$	101	57	49	21
E	10,920	11,520	10,000	6,877
Rule (r)				
r	2	2	4	3
E	10,900	11,280	9,701	6,707
$E(m_c)$ at PNQL	305.8	259.2	78.64	56.63
Rule (N, R)				
N	400	175	97	44
R	3	3	5	4
E	11,990	11,260	9,737	6,821
$E(m_c)$ at PNQL	356.7	172.1	94.99	43.78

In practice, it is not difficult to carry out all these calculations on a "log log duplex decitrig" slide rule, and within the limits of accuracy of such an instrument —or, in fact, within those required by the problem—it should rarely be necessary to go beyond c_3. Often c_1 alone will lead to a sufficiently accurate answer for i.

The next step is to find f. This can be done most quickly by referring to the chart of values of f and i for constant AOQL in Dodge's articles.[1, 2] Otherwise, f may be found from the equation for F in Table IV to be given by

$$\text{Log } g = \text{Log } F - \text{Log}(1-F) + i \text{ Log}(1-P)$$
$$f = g/(1+g) \qquad (5)$$

(The base of the logarithms may be chosen as convenient). In our example, f = 0.0498, rounded to 0.05.

Choosing a Stopping Rule

After the CSP-1 plan has been chosen, we find a number r, to determine the recommended stopping rule. This rule is to *stop as soon as r defective units are found in any one screening sequence.* (See Rule (r), Table I.) Besides a PNQL, an F at the PNQL, and the i of the CSP-1 plan, we must specify one more number to find r. This number, which we will call E, is the *average number of units produced between successive stops* when the process average is at the PNQL. Naturally, this average should be chosen large since stopping while the process is at the PNQL should generally be waste motion. In our illustrative examples, we have chosen E = 10,000 units produced at the PNQL.

In order to find the proper value of r, find the block of columns in Table V beneath the appropriate value of the product of E and F. In that block find the column corresponding to the value of PNQL and then the row in that column such that the value of i lies between the two entries shown in that cell. Read r in the left margin of that row. This table covers the range $1 \leq r \leq 15$, $5 \leq i \leq 500$, and the values of EF and P shown in the column heading. If the proper combination cannot be found in Table V, r may be computed from

$$r = -\frac{\text{Log}\{1 + EFP(1-P)^i\}}{\text{Log}\{1 - (1-P)^i\}} \qquad (6)$$

(The base of the logarithms may be chosen as convenient.)

In the example from the preceding subsection we had F = 0.10, i = 150 and chose E = 10,000. Therefore, EF = 1000 and, reading in Table V, i falls between 101 and 230. The number in the margin is r = 2. Thus the rule is to stop as soon as two defectives are observed in any one screening sequence. (The defective which caused the screening sequence to start is excluded from the count.)

Stopping Rules Chosen for Study

The first stopping rule for CSP-1 plans appeared in NAVOSTD 81, *Sampling Procedures and Tables for Inspection by Attributes on a Moving Line,* U. S. Navy, 1952. This procedure calls for stopping as soon as a specified number of defective units is found during a given period of production. The inspection procedure is by no means identical to a simple CSP-1 plan; the f and i parameters are chosen on the basis of estimated production during a given period, and a new screening sequence begins each such period regardless of the previous period's results.

Some difficulty has been found in computing statistical characteristics of the Navy plan.[5, 6] We choose instead to study a stopping rule somewhat similar to the Navy rule and proposed to the writer by J. W. Tukey. It eliminates most of the mathematical difficulty and also leaves the original CSP-1 plan unchanged. This rule, referred to hereafter as Rule (N, R), is to stop as soon as a specified number of defectives, R, are found in any block of a specified number, N, of successive inspected units. It is assumed that each inspected unit is associated with one and only one block.

Another stopping rule was recently proposed by the present author.[7] The rule is to stop as soon as a specified number n^* of units have been inspected in any one screening sequence without ending it. Again the inspection procedure is different, although only slightly so, from a CSP-1 plan: a new screening sequence is started when inspection is resumed after stopping, whether or not the last (n^{*th}) unit in the interrupted screening sequence was defective. We shall call n^* the critical length and refer to this rule as Rule (n^*). Its virtue is its simplicity of operation and the relative ease of choosing the value n^*.

The values of n^* suggested by the writer[7] were calculated on the premise that inspection—at least so far as the sampling phase of CSP-1 is concerned—is conducted by a customer's agent and that stopping production is not necessarily involved. It may be inferred from what follows that these values of n^* were liberal (i.e., large) for the purposes of the manufacturer who wishes to use a stopping rule based on inspection results as an aid in controlling production.

A change in Rule (n^*) may be made which leaves the CSP-1 plans unchanged but which calls for stopping a specified screening sequence if, and only if, Rule (n^*) does. This new rule, which we shall call Rule ($n^* - i$), is to stop as soon as a defective unit is found in any one screening sequence after the sequence has exceeded $n^* - i$ units. As a matter of interest we include comparisons of characteristics of Rule (n^*) and Rule ($n^* - i$).

Another rule may be easily devised. It calls for stopping as soon as a specified number of defective units, r, are found in any one screening sequence. Thus it resembles Rule ($n^* - i$) in that the only information used is that in screening sequences, and it resembles Rule (N, R) in that it is based on a count of defective units. We shall call this third stopping rule Rule (r).

TABLE IV—Expressions for F, E(m), and $E(m_0)$

	F	E(m)	$E(m_0)$
Basic CSP-1 Plan	$t/[t + (1-t)q^i]$	—	—
Rule ($n^* - i$)	"	$(1-T_{n^*})/pq^iFT_{n^*}$	—
Rule (r)	"	$(1-D_r)/pq^iFD_r$	$FD_rE(m)$
Rule (N,R)	"	$E(m_0)/FB_N(R)$	$N - B_N(R) - B_{N+1}(R) - \ldots - R_{N-1}(R)$
Rule (n^*)	$t/[t + (1-t)q^ik]$	$(1-T_{n^*})/pq^iFT_{n^*}k$	—

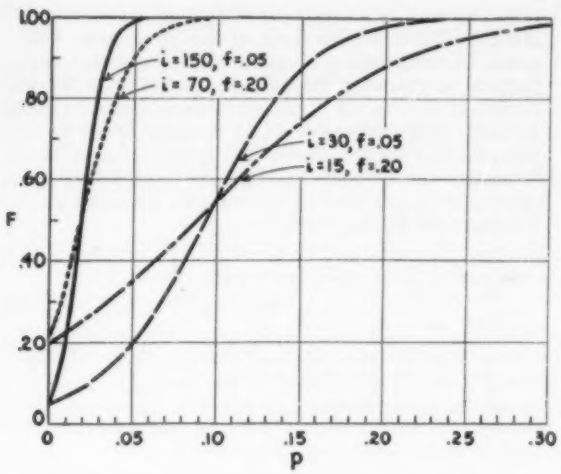

Figure 1—Total Fraction of Units Inspected, F, versus Process Average, p, in CSP-1 Plans

We observe that none of the three Rules (N,R), (n* − i), and (r) alters the basic CSP-1 plan since each is invoked only on certain occasions when the last unit inspected is defective. Thus when the process is begun after stopping, the ensuing screening sequence would be required even under the CSP-1 plan without any stopping rule. As previously mentioned, any CSP-1 plan is altered by the use of Rule (n*).

A summary of the four stopping rules which concern us is presented in Table I.

A Method for Comparing Stopping Rules

For each of the four stopping rules to be discussed, the number of units, m, produced until a particular stopping rule is first invoked is a chance quantity. We shall call it the length of a stopping cycle. It depends not only on the kind of stopping rule but also on the choice of the values of the parameters n*, r, or N and R. Expressions for the average† of this quantity, E(m), are given for these four rules in Table IV.† Even for a completely specified stopping rule, E(m) varies as the process average, p, varies. We may thus plot E(m) as a function of p to obtain what may be called an E(m) curve.

It is sufficient to compare the various stopping rules in terms of their E(m) curves if the following mathematical assumptions are used:

(i) Probability sampling is used in the CSP-1 plan when sampling is required;

(ii) The production process may be represented as a sequence of independent trials with the probability of a defective unit (process average) being p = 1 − q.

The assumption (ii) is perhaps too rigid to be considered the mathematical equivalent of a state of statistical control, but this limitation appears not to challenge seriously the propriety of using CSP-1 plans in the "real world." The reason it is used here is its simplicity—with

†E. S. Page[3] introduced a similar concept (Average Run Length = A.R.L.) for stopping rules in any continuous sampling plan on the basis of units inspected rather than produced.

†The variance of m, V(m), is known for all rules except Rule (N, R). The mean and variance of m_r, the number of units inspected until a particular stopping rule is first invoked, are known for all four rules.

TABLE V—Table of r for Rule (r)

EF =	500				1000				1500				2000				2500			
PNQL =	0.005	0.010	0.025	0.050	0.005	0.010	0.025	0.050	0.005	0.010	0.025	0.050	0.005	0.010	0.025	0.050	0.005	0.010	0.025	0.050
r	Range of i				Range of i				Range of i				Range of i				Range of i			
1	20-220	5-50	5-8		6-100	5-27	5		5-69	5-19			5-54	5-15			5-45	5-13		
2	221-500	51-114	9-22	5-7	101-230	28-65	6-14	5	70-162	20-50	5-11		55-131	16-42	5-10		46-113	14-37	5-9	
3		115-193	23-36	8-13	231-388	66-104	15-24	6-9	163-259	51-81	12-20	5-7	132-210	43-70	11-18	5-6	114-182	38-62	10-16	5-6
4		194-327	37-49	13-16	389-500	105-143	25-34	10-12	260-363	82-111	21-28	8-10	211-287	71-96	19-25	7-10	183-248	63-86	17-23	7-9
5		328-500	50-62	17-21		144-183	35-43	13-16	364-484	112-140	29-36	11-14	288-367	97-120	26-33	11-13	249-313	87-109	24-30	10-12
6			63-74	22-25		184-225	44-51	17-19	485-500	141-168	37-43	15-17	368-452	121-144	34-39	14-15	314-378	110-130	31-36	13-14
7			75-88	26-29		226-274	52-59	20-22		169-195	44-50	18-20	453-500	145-166	40-45	16-18	379-445	131-150	37-42	15-17
8			89-102	30-33		275-330	60-67	23-25		196-223	51-57	21-22		167-188	46-51	19-20	446-500	151-168	43-48	18-19
9			103-118	34-36		340-461	68-74	26-28		224-252	58-63	23-25		189-209	52-57	21-23		169-187	49-53	20-21
10			119-139	37-40		462-500	75-81	29-30		253-284	64-68	26-27		210-230	58-62	24-25		188-205	54-58	22-24
11			140-170	41-43			82-88	31-33		285-319	69-74	28-29		231-252	63-67	26-27		206-223	59-62	25
12			171-500	44-46			89-95	34-35		320-363	75-79	30-31		253-274	68-71	28-29		223-239	63-67	26-27
13				47-50			96-101	36-37		364-423	80-84	32-33		275-297	72-76	30-31		240-256	68-71	28-29
14				51-53			102-108	38-39		424-500	85-89	34-35		298-322	77-80	32		257-274	72-75	30-31
15				54-57			109-116	40-41			90-94	36-37		323-350	81-84	33-34		275-292	76-79	32

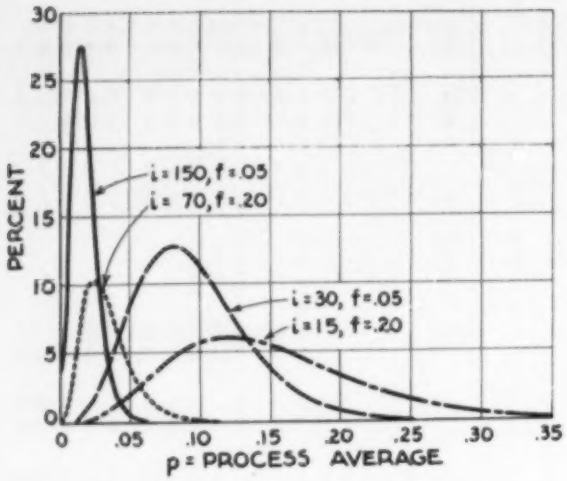

Figure 2—Percentage Increase in Total Fraction Inspected When Using Rule (n*)

the hope that at least the qualitative inferences which may be drawn from the results below will be substantially correct.

In order to make a specific comparison between E(m) curves for different stopping rules, we need to choose values for the parameters so that this comparison is reasonable. While a CSP-1 plan may be chosen on the basis of AOQL, PNQL, and total fraction of units inspected at the PNQL, we need something more to enable us to choose the values of the parameters just mentioned. First, we choose a common value of E(m) which all three rules, operating separately, are to have when the process average is at the PNQL. We have designated this value as E. This means that at the PNQL all three rules have the same long-run chance of indicating trouble. In our numerical examples, it will be recalled that we chose E = 10,000. This number is large enough to obtain r greater than unity in the illustrative CSP-1 plans given in Table III. Fixing E is enough to determine n* and r. We have chosen to apply the value of n* found for the illustrative cases to Rule (n*) as well as to Rule (n* − i) so that we may compare E(m) and total fraction of units inspected for these two rules.

Rule (N, R) depends upon both N and R, which we cannot determine by the single specification of E alone. We add, therefore, a restriction on what may be called the average length of a counting cycle of defectives. With Rule (r) we begin counting defectives over again either because a new screening sequence begins or because we have just found r defectives without completing a screening sequence. With Rule (N, R) we begin counting defectives over either because we have just finished a block of N inspected units without finding R defectives or because we have just found R defectives within such a block. In each case the number of units inspected from the first unit inspected until the counting of defectives starts again we call the length of a counting cycle m_C. The average of this length, $E(m_C)$, is determined for Rule (r) at the PNQL as soon as r is chosen, and we specify that $E(m_C)$ for Rule (N, R) at the PNQL be as close to it as possible. For the latter rule m_C cannot exceed the block size N, and the same applies to $E(m_C)$. The conditions on E(m) and $E(m_C)$ for Rule (N, R) determine the parameters N and R.

The values of the parameters of the various stopping rules—chosen in accordance with these principles—are given in Table III for each of the illustrative CSP-1 plans. In computation it appeared that it is not always possible to choose values of r so that E = 10,000 precisely. The values of n*, N and R were chosen to obtain a match to the values of E(m) actually found first for the values of r most closely satisfying the specification. Formulas for n* and T_n, used in constructing E(m) curves, were provided in the author's previous paper.¶ For Rule (N, R) the formula

$$E(m_C) = N - (N - R + 1)B_N(R - 1) + (1 + Rqp^{-1})B_N(R) \qquad (7)$$

was used rather than the one shown in Table IV. Equation (7) can be established by the method of generating functions which was used, along with the theory of recurrent events,† to derive the expressions for the averages shown in that table.

Results of Comparing Stopping Rules

The results of our computations are summarized in Table III and the six figures. In the latter the abscissa is process average, which is shown on an arithmetic scale in Figures 1 and 2 and on a logarithmic scale in Figures 3, 4, 5, and 6.

Figure 1 shows the total fraction of units inspected, F, for each of the four illustrative CSP-1 plans. These values of F obtain when the basic CSP-1 plans are used and also when Rule (n* − i), (r), or (N,R) is applied to the same plans. Figure 2 shows the percentage increase in the values of F over those in Fig. 1 when Rule (n*) is applied to the basic CSP-1 plans.

¶See Ref. (7), Appendixes B and C.
†See Feller,[9] Ch. 11, 12, and 13.

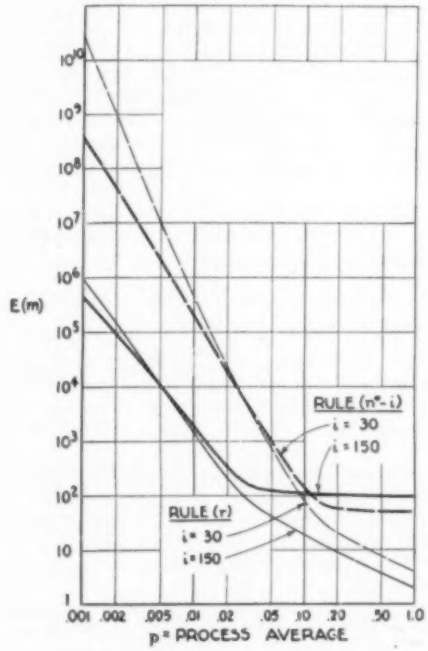

Figure 3—Average Length of Stopping Cycle: Rule (r) and Rule (n* — i)

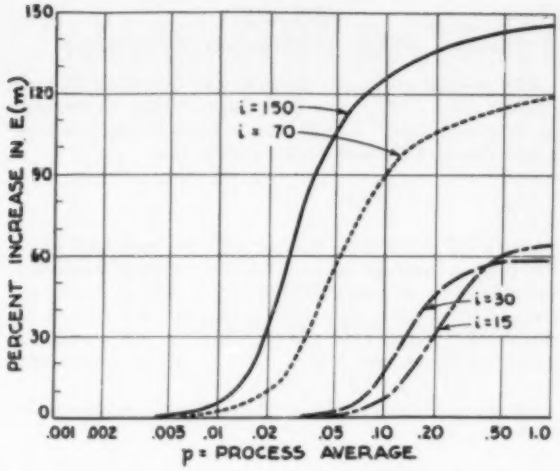

Figure 4—Increase in E(m): Rule (n*) over Rule (n* — i)

Figure 3 shows the E(m) curves when Rule (n* — i) or Rule (r) is applied to either illustrative CSP-1 plan having an F of 0.10 at the PNQL. A logarithmic scale is used for the ordinate.

Figure 6 shows the percentage increase—in some cases negative (i.e., a decrease)—in the values of E(m) over those presented in Fig. 3 when Rule (n* — i) or Rule (r) is applied to either illustrative CSP-1 plan having an F of 0.25 at the PNQL. The increase is calculated as a percentage of the corresponding value of E(m) in Fig. 3 pertaining to the same stopping rule and the same AOQL.

Figure 4 shows the percentage increase in the values of E(m) over those pertaining to Rule (n* — i) when Rule (n*) is applied to the four illustrative CSP-1 plans. Figure 5 shows the percentage increase—in some cases negative—in the values of E(m) over those pertaining to Rule (r) when Rule (N,R) is applied to the four illustrative CSP-1 plans.

From Figures 3, 4, 5, and 6 it is possible to construct a total of 16 E(m) curves—one for each combination of the four plans and the four stopping rules. The percentage figures in Figures 4, 5, and 6 indicate that the curves in Fig. 3 represent four distinct types evident among the 16 separate E(m) curves.

Study of Table III and the figures indicates that:

(a) For a given CSP-1 plan, the value of n* chosen for quality control purposes is generally smaller—sometimes many times smaller—than the corresponding value of n* for limiting inspection effort. (See the values of n* tabled in Ref. (7).)

(b) In contrast to its application as a means of limiting inspection effort,† Rule (n*)—when applied as above to the control of quality—can lead to appreciably higher percentages of inspection than the other three rules. (See Fig. 2.)

(c) Rule (r) is more sensitive to changes in process average than Rule (n* — i): the E(m) curve for the former plan has a steeper slope than that for the latter, which flattens out markedly as the process average increases. (See Fig. 3.)†

(d) When matched as here, Rule (n*) and (n*—i) have about the same E(m) curves until they both begin to flatten out. (See Fig. 4.)

(e) When matched as here, Rules (r) and (N,R) have quite similar E(m) curves. (See Fig. 5.) If the specification with respect to $E(m_0)$ were removed and N and R were increased in such a manner as to preserve the same value of E, the result would be larger values of E(m) for Rule (N,R) for both lower and higher values of process average.

(f) For any of the four stopping rules considered here, the A-P-E combination is the controlling factor with respect to the E(m) curve. The particular f and i combination, corresponding to a selected value of F at the PNQL, seems to make less difference in this respect. (See Figures 4, 5, and 6.)

Conclusions

The study indicates that Rule (r) or Rule (N,R) is to be preferred as an aid in controlling quality and that under certain reasonable circumstances these are roughly equivalent for CSP-1 plans. The single parameter r is considerably easier to choose than the pair of parameters N and R as is evident from inspection of equations (6) and (7), of which the first is obtained from Table V.

Thus, for CSP-1 plans, it appears reasonable and convenient to use Rule (r) as an aid in controlling quality. For more complex continuous sampling plans, the question remains open. However, in existing Multi-Level Continuous Sampling plans[4,10,11,12] it is easy to see that Rule (r) could be readily applied in screening sequences.

Acknowledgment

My thanks are due to Miss Judith Zagrodnick, who did the extensive calculations necessary to the preparation of this article, and to Miss Alice G. Loe, who drew the figures.

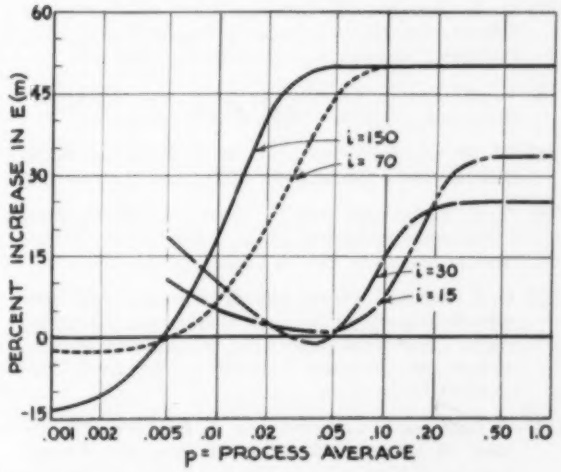

Figure 5—Increase in E(m): Rule (N,R) over Rule (r)

‡See Ref. (7), Section 2.3, p. 123, 124.

†As the process average nears unity, E(m) approaches n*, n* — 1 + 1, r, and R for Rules (n*), (n* — i), (r), and (N,R) respectively. Ordinarily the first two of these values will be appreciably larger than the other two.

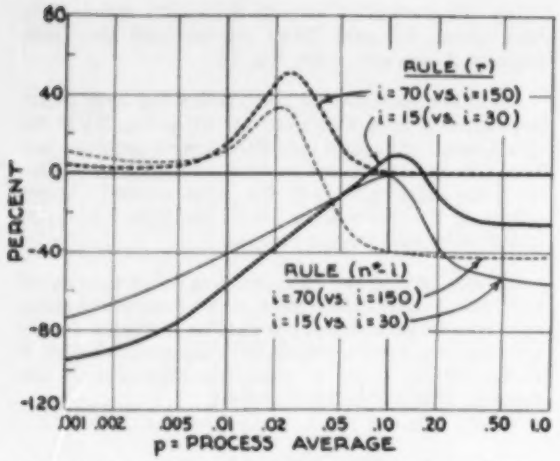

Figure 6—Comparison of E(m): Effect of Change in F at PNQL

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APPENDIX

Calculation of i for a CSP-1 Plan with Specified A, P, F

For process average p the Average Outgoing Quality (AOQ) for a CSP-1 plan (i.e., f and i) may be denoted by A(p). Dodge[1] has shown, subject to the assumptions (i) and (ii) used in this article, that

$$A(p) = p\{1 - F(p)\}$$

where F(p) is the total fraction of units inspected when the process average is p. Also, under these same assumptions, he shows that there is a unique value, p_0, for a CSP-1 plan such that $A(p_0) \geq A(p)$, and he defines $A = A(p_0)$ as the AOQL. As a consequence it can be shown that $F(p_0) = (1 - A)/(1 + iA)$ and $1 - p_0 = (1 - A)\,[1 - 1/(i + 1)]$.

For fixed f and i it can be shown from equations (5) that

$$\frac{f}{1-f} = \frac{F(p)}{1-F(p)}\,(1-p)^i = g \qquad \text{(A1)}$$

for all p $(0 < p < 1)$. Equating the right-hand sides of (A1) for $p = p_0$ and $p = P$ (= PNQL), we find

$$i + 1 = \frac{\{1-F(P)\}(1-P)}{AF(P)}\left(\frac{1-A}{1-P}\right)^{i+1}\left(1 - \frac{1}{i+1}\right)^i$$

$$= ae^{-b(i+1)}\,e\left(1 - \frac{1}{i+1}\right)^i \qquad \text{(A2)}$$

where a and b are given by equations (2) above. There is a unique solution $u \geq 1$ of

$$u = ae^{-bu} \qquad \text{(A3)}$$

if $b \geq 0$ and $1 \leq ae^{-b}$, and under these same conditions, equivalent to those in (1) above, there is a unique (generally non-integral) solution $i + 1$ of (A2) such that $i + 1 > u$.

As the solution $i + 1$ of (A2) increases, the difference $i + 1 - u$ decreases, and the maximum difference (in the limiting case $b = 0$, $i = 0$) is about 0.65. Formally it is easy to show that $i + 1 - u$ is less than $\frac{1}{2}$ + a term of order $(i + 1)^{-1}$. In any case, [u] deviates by at most unity from the integer nearest to the value of i satisfying the specification of A, P, and F(P).

If $b > 0$, substitute $x^* = bu$ in (A3) so that

$$x^* = abe^{-x^*} > ab\,(1 - x^*), \qquad \text{(A4)}$$

or

$$x^* > \frac{ab}{1+ab} = c_0$$

The derivative of $f(x) = abe^{-x}$ is negative increasing. If the tangent line to $y = f(x)$ at $x = c_0$ intersects the line $y = x$ at $x = c_1$, then $c_0 < c_1 < x^* < abe^{-c_0} < abe^{-c_1}$. We repeat this procedure with the tangent line to $y = f(x)$ at $x = c_1$ to find c_2 and so on, to obtain an increasing sequence of c_n which can be shown to have x^* as a limit. The values c_n/b then approach u from below while the values ae^{-c_n} approach u from above. This procedure gives rise to equations (3) and (4).

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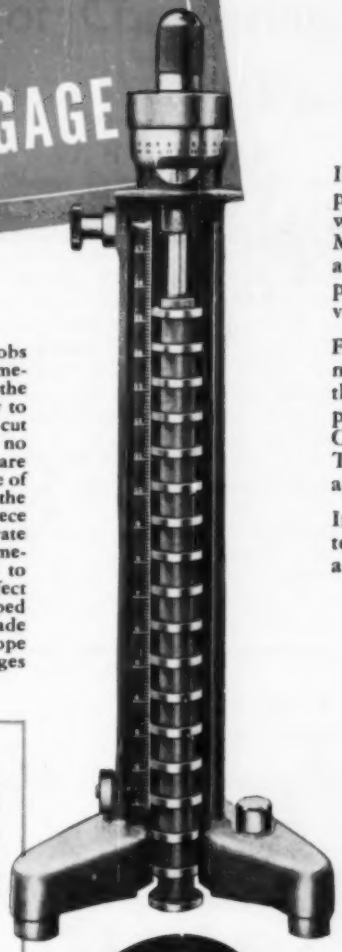

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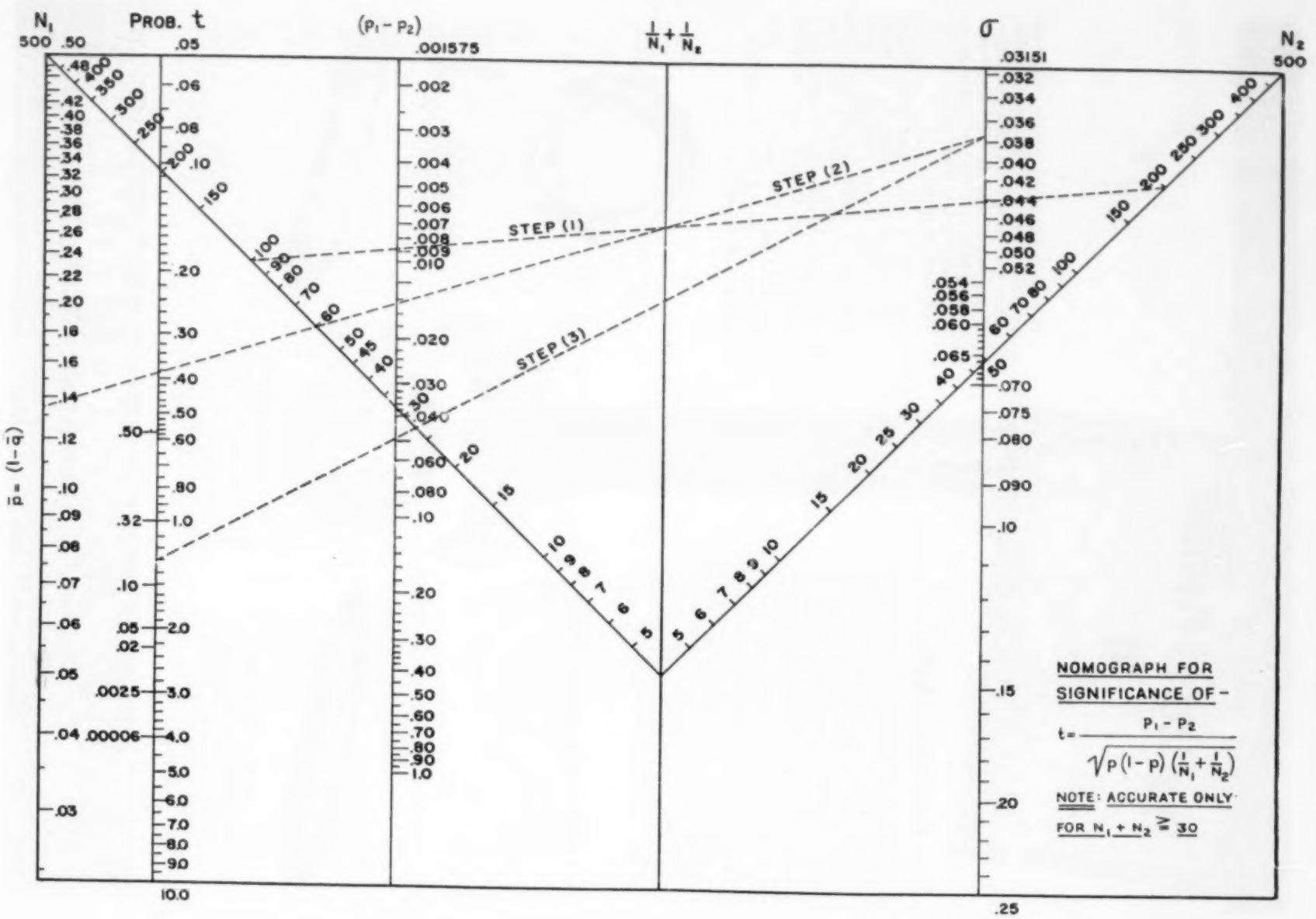
N1
Prob. t
(P1 - P2)
1/N1 + 1/N2
σ
N2
500
.50
.05
.001575
.03151
500
STEP (1)
STEP (2)
STEP (3)
p̄ = (1 - q̄)
NOMOGRAPH FOR
SIGNIFICANCE OF -
t = (P1 - P2) / √p(1 - p)(1/N1 + 1/N2)
NOTE: ACCURATE ONLY
FOR N1 + N2 ≥ 30
10.0
.25

$N_1\%$ A Rapid Method of Comparing Two Percentages $N_2\%$

J. H. FAIRFIELD
Argus Camera Company, Ann Arbor, Michigan

A frequent problem arising in industrial experimentation is the comparison for significant difference of results obtained from attributes testing of samples from two lots or processes. If the lots from which the samples are drawn are fairly large (at least ten times the corresponding sample sizes), the sample fractions defective, p_1 and p_2 will follow a binomial distribution. In addition, if the combined sample is fairly large (at least 30), the difference $p_1 - p_2$ of the lot percentages may be assumed to be normally distributed. When the data fit these assumptions, a comparison of the two lots for a significant difference can be made very quickly with the nomograph presented on page 22.

For example, consider two lots of condensers of quantity 5000 offered to a radio manufacturer. A sample of 100 from lot 1 and 200 from lot 2 are tested for breakdown voltage, revealing 10 and 30 defectives respectively. Which lot should be purchased?

Four simple preliminary calculations, which can be done mentally in many cases, are required, as follows:

$$p_1 = 10/100 = 0.10$$
$$p_2 = 30/200 = 0.15$$
$$p_1 - p_2 = 0.05$$
$$\bar{p} = 40/300 = 0.133$$

Step (1)

Locate $N_1 = 100$, $N_2 = 200$ on the N_1 and N_2 scales, connect with a straightedge, and mark the point of intersection with the line labelled $\left(\frac{1}{N_1} + \frac{1}{N_2}\right)$

Step (2)

Locate $\bar{p} = 0.133$ on the $\bar{p}$ scale and connect with a straightedge to the point marked on the $\left(\frac{1}{N_1} + \frac{1}{N_2}\right)$ line. Read $\sigma = 0.038$ on the σ scale. [If $\bar{p}$ is greater than 0.50, enter the p scale with $\bar{q} = (1-\bar{p})$].

Step (3)

Locate $|\ p_1 - p_2\ | = 0.05$ on the $(p_1 - p_2)$ scale. Connect this point with $\sigma = 0.038$ and read off $t = 1.33$ and the corresponding probability 0.20 (approx.).

The probability figure obtained indicates that, if there were no difference in the two lots, a t value of 1.33 or more would be expected about 20 percent of the time. The presumption, therefore, is that there is probably no significant difference in the two lots.

If, however, the manufacturer decides to purchase Lot 1 because he feels that a 1 in 5 risk is a good gamble in judging Lot 1 to be superior to Lot 2, he will be in error on his estimate of risks. The test built into this nomograph is a two-tail test designed to judge differences in *either* direction, not just *one* direction, between the two cause systems sampled.

If we ask the question "How likely are we to get a $t \leqq -1.33$ when, in fact, there is no difference between the lots?", the answer is about 0.10 rather than 0.20. So the manufacturer would be talking about a 1 in 10 rather than a 1 in 5 risk by rejecting his belief in the equality of the lots in favor of Lot 1.

Thus, one-tail tests may be handled from this nomograph by merely dividing by two the probability answer it gives.

Mathematical basis for this significance test may be found in most textbooks on elementary statistical techniques, such as Hoel's *Introduction to Mathematical Statistics*, Second Edition, John Wiley and Sons, Inc., New York (1954), p. 110-113.

ASQC LCS Codes 510; 552:60; 70:000.

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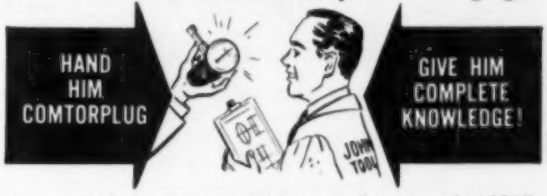

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2. front or back taper, exact amount of.
3. ovality, exact amount of diameter variation.
4. bell mouth or barrel shape.

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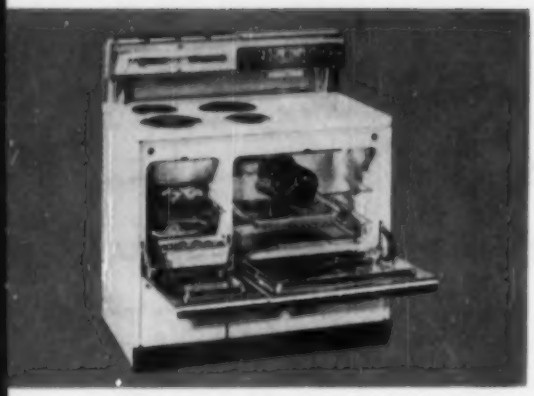


IS IT TRUE THAT IF EVERYBODY DID THEIR JOB RIGHT THERE WOULD BE NO NEED FOR QUALITY CONTROL IN AMERICAN INDUSTRY?

IS QUALITY CONTROL MERELY AN ORGANIZATIONAL CONCEPT?

ARE THERE TECHNOLOGIES OVER AND BEYOND THE MERELY ANALYTICAL THAT ARE UNIQUE TO THE QUALITY CONTROL FIELD?

Professional QUALITY CONTROL ENGINEERING

A. V. FEIGENBAUM

General Electric Company

The emergence of Quality Control as an essential distinct and major function in American industry is rapidly becoming an established fact. Rarely in business history has an activity like Total Quality Control been accepted so quickly by business management.

This rapid rate of acceptance is not an unmixed blessing. It carries with it some great problems. Despite its critical importance, the great need for the work and its increasing acceptance—the true professional nature of Quality Control Engineering remains one of the least understood and, therefore, one of the least fully practiced technical activities in America today.

It is our purpose in this article to focus attention on the true character of our work. It is our purpose to make a brief but comprehensive coverage of the professional scope of the American Quality Control Engineer.

We shall begin by asking three questions:

First—Is it true that if everybody did their job right there would be no need for Quality Control in American industry?

Second—Is Quality Control merely an organizational concept?

Third—Are there technologies over and beyond the merely analytical that are unique to the Quality Control field?

ASQC LCS Code 000:00:000

Keep these three questions in mind as this discussion proceeds. Perhaps the greatest single failing of quality control men is the failure to think through to good answers to these questions—and more important—to communicate such answers to others. For example, do Industrial Engineers, Product Engineers, Manufacturing Engineers really believe in their hearts that Quality Control Engineering is a technology as primary as their own? Do quality control engineers believe it themselves? Does industrial management see quality control as a genuine technical function—or does it see it as a currently fashionable marriage of convenience to satisfy customers and the public?

A number of years ago when inspection work was the hard core of quality control, many manufacturing and engineering people thought of the inspection function as a "necessary evil." They thought of this work essentially as a "no value added" kind of activity.

This type of attitude will never develop for modern quality control if we from the beginning identify our work as basically technological and as fundamentally professional and if we earn the acceptance of these labels.

Editorial Note

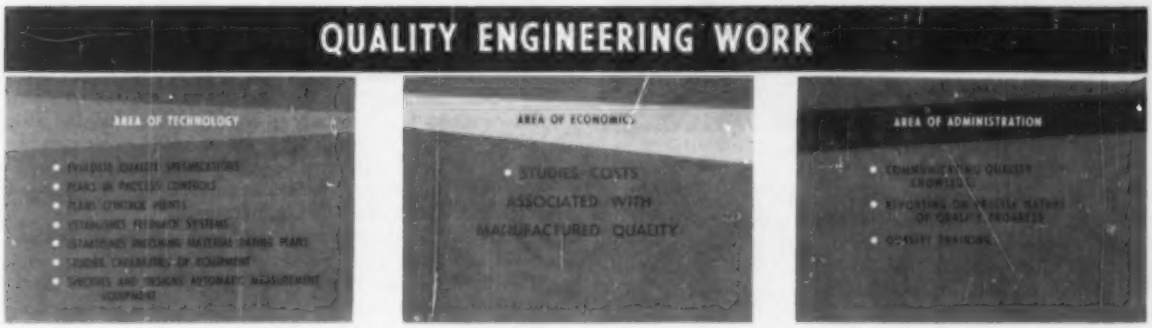
One of the most popular sessions at the 13th Annual Convention in Cleveland was the series, "Professionalism in Quality Control." Your editors take pleasure in presenting this series now to the readers of *Industrial Quality Control*, leading off with Mr. Feigenbaum's, "Professional Quality Control Engineering." The other talks in the series will be presented in future issues.

MEW

The Business Facts of Life

First let us come squarely to grips with the business facts of life that make such identification not only possible from the quality control man's point of view—but also make it essential from the businessman's viewpoint: the competence of its implementation; its closeness to a business integrity; its proof of positive performance—will be a decisive factor in the growth and profitability of most American enterprises in the decade of the 1960's.

In the following years, fuses were replaced with circuit breakers, an audible alarm was added to the meat thermometer system, removable oven doors were introduced, a more precise electronic timer was introduced and a rotisserie was added. Finally, the hydraulic control for the automatic surface unit was replaced by an electrical control system—while at the same time the grid control circuit was revised to simplify the number of operations. This, of course, involved the introduction of a complicated selector switch in place of a simple toggle switch.



We must come to realize that the implementation of Total Quality Control requires more than administrative activity and, of course, more than quality assurance work. It requires a business, an engineering and a scientific contribution by us that goes to the very roots of the economic and technological ability of a business, large or small, to manufacture and market products at a performance that meets the basic economic tests of a free market place economy.

You know as well as I, that in your business as well as mine, in product development after product development, the requirements for meeting progressively increased product and quality standards is one of the most basic of all problems that structure the economics of our product lines.

Product quality and reliability have become a more vital business factor than ever before. Today's customers demand higher and higher product quality and the prediction is that this demand will intensify rather than diminish in the years ahead—in motors and generators, in appliances, in chemicals, in electronic equipment, in many, many other products.

Technological Implications

There are, of course, many technological implications connected with these higher customer quality requirements.

Let us look at only two.

As a case in point, let us look at a relatively commonplace household item—an electric range. In 1946, the range had a simple incandescent cooktop lighting, a single oven, warmer drawer, four surface units with manual controls, an oven timer and an internal timer —many components and no mean quality job.

Three years later, the warmer drawer was eliminated and a companion oven was added. The incandescent cooktop lighting was replaced with a pair of fluorescent lamps with associated lampholders, ballasts, starters and switches.

Today, we have, of course, a much improved electric range that provides increased value to the customer. We also have many more components than in 1946—and a much bigger quality job. There needs to be a great deal *more* attention devoted by Quality Control to assure the quality and reliability of this new, much more complex range design.

In other products, involving much more advanced mechanical hydraulic, electronic and chemical components, the picture that emerges is equally clear. The demand for quality engineering knowledge is far greater today than ever before and this trend will greatly increase during the 1960's.

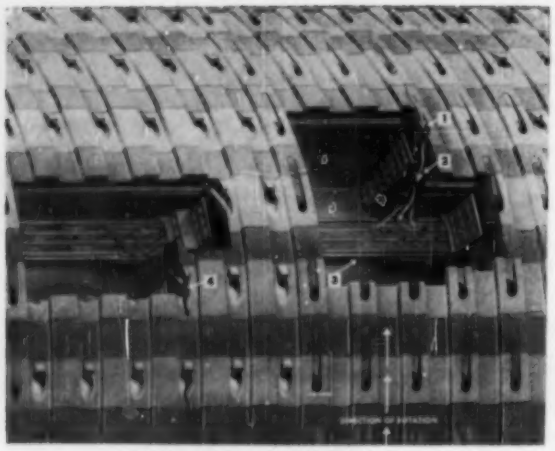
The second technological implication resulting from increased customer quality requirements comes out of the increased complexity of manufacturing processes themselves—particularly the progressive trend toward mechanization.

The rapid development of new tools and techniques in the manufacturing function has made a fundamental change in the very nature of the manufacturing function in many businesses. Such arm-lengthening tools as computers, data processing of all kinds, new work simplification methods, new types of recording instruments, programmed machine tools, feedback controls, atomic tracers for checking machineability, and a host of others have opened many productivity improvement doors that were formerly closed to us.

For example, a look at the manufacture of field conductors for large generators points up the use of the new area of programmed machine tools.

Only a few years ago, the field conductors were made of solid rectangular copper sections that were edge wound with the help of a rawhide hammer.

Today, each conductor is now hollow with various internal milled passages slotted to align with radial holes through the rotor body. These holes, in turn, align with scoop type holes through the wedges covering each coil slot. You might note, that scoop #1 feeds hydrogen to the 4th coil layer from the top—the scoop to the right of #1 feeds the 3rd layer and so forth. The synchronizing of all these holes is a little difficult to say the least.



Milled Generator Field Conductor

The point of great interest to us here, is that with this new improved design for field conductors, the milling of the various passages in the field conductors is done on a *6-headed, punched-card controlled milling machine.* We get, of course, increased quality and product efficiency; but the quality planning input to this kind of manufacture demands infinitely greater technical contributions by quality control men.

Change in Work

The continuing upward trends of technical complexity both in products and in manufacturing processes greatly change the kind of technical work that is demanded from quality control men. This change will increase on an exponential basis as we proceed into the 1960's. From the standpoint of professionalism, it seems to me that we should be concerned with preparing ourselves for this future ahead of us—with the practical means for doing the technical job that lies ahead—not to recite some of our successes in doing a much narrower quality control job in comparison with the less demanding era of the past.

Stated another way, I think we should devote some of our professional consideration to something more than merely resolving to do today's job more efficiently or only to try to inject more quality into today's products. We should instead—as true professionals—focus on our future and:

—critically analyze our *existing* quality control structures
—identify the changes that are taking place, and then
—make plans for the basic revision that will equip us to cope with these important trends

Revisions in Concepts

Consider now some of the widespread revisions that we must make. The first is that we must put ourselves into the position that quality is *planned for*—that it doesn't merely happen. This requires our completing a management revolution, if you will, whereby key members of top management come to see that product quality requires planning as a businesswide system—like marketing, like product engineering, like personnel. We must eliminate our still prevalent practice of atomizing this work so that it exists only in piecemeal fragments called reliability, or inspection, or statistical analysis, or factory troubleshooting, or what have you.

So the first major revolution that we need to make our future possible requires that we plan product quality as a business-wide system. And this first revolution leads directly to a second one: to explode the scope of the *Quality Control Engineer's* job to cover truly professional technical activities throughout this entire cycle.

The reason for this second revolution you understand very well. It is that quality work is a multi-functional activity—a broad *company-wide* technical program.

Each phase of the industrial cycle affects product quality in one way or another; whether it is the first customer contact through marketing; or converting customer wants into specifications through engineering; or whether it concerns building and shipping products by manufacturing; or whether it involves customer servicing.

The planned business quality system that I am talking about ties together the related quality responsibilities of these major business contributors. Briefly, this quality system includes the administrative structures and the written policies that give direction to the business-wide quality activities and which specifies the control required throughout manufacturing.

Some of the details required in this kind of professional approach were briefly spelled out in the report, "The Professional Work of the Quality Control Engineer," that appeared in the February 1958 issue of *Industrial Quality Control.* That report was the first step taken in our Society's long-range program on professional development.

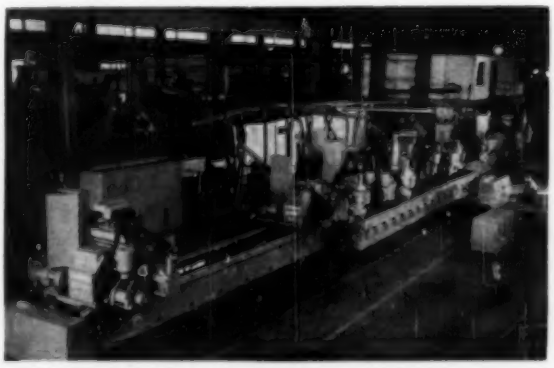
Basic Fundamentals of Quality Control Engineering Work

You will recall that we began this discussion by raising questions about the degree to which the quality control engineer's work is truly technologically oriented—rather than being merely a matter of stimulation and of coordination. I made the point that we will be professionals in quite close proportion to the degree that there are unique technological contributions made by the work of the quality control engineer.

To what degree can we identify major technological areas in quality control engineering? I believe there are at least three such areas:

1. The product or process area
2. The economic area
3. The administration area

I would like to use this three-phased focus to review in some depth the basic fundamentals of quality control engineering work.



Punched Card Controlled Milling Machine

The Product and Process Area

In the product and process area, the quality engineer must play a major role in the quality planning of new product designs. He must be able to evaluate the extent to which quality specifications can be consistently maintained.

The quality engineer plans the in-process controls for assuring conformance between specifications and the finished product. He plans the control points, the tools for measuring and the critical measurements to be taken.

His is the key responsibility of establishing the feedback system that corrects adverse quality trends in production before the failure takes place. Should bad products be produced, his feedback system must reduce the possibility of repeating the mistake that caused the failure.

Quality control equipment is also an important consideration of this phase of the quality system. The quality engineer must specify and procure—in some cases actually design—the automatic measuring and control equipment that must be a basic part of any mechanized or automated line if it is to achieve its maximum productivity.

This kind of equipment should be genuine quality control equipment rather than merely mechanized sorting which accomplishes only sorting out bad products faster than we have before. As a case in point of the right approach to this work, I like to refer to an "Automatic Crosstalk and Bonding Unit" for deflection yokes developed in our TV Department.

First, a word about the process involved. Cross-talking is the process of mechanically adjusting one coil with respect to another so that neither coil will interfere electrically when the fields generated by the coils are at right angles to each other.

Normally, the coils were manually adjusted and tested in fixtures by cross-talk operators. The indication of cross-talk limits was observed on a meter, and the proper phase on an oscilloscope. The coils were next asided to the moving line. Then, operators would remove them from the line and apply Zopher wax to six different positions for holding the coils in their proper positions.

Obvious disadvantages of this method were:

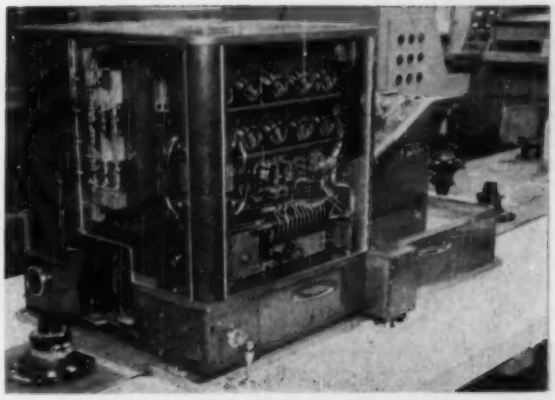
1. Unreliable cross-talk settings
2. Coils would go out of proper adjustment before applying the wax
3. This was a very expensive process

So, there were many variables that affected good quality in addition to generating high quality costs.

During New Design Control work, an "automatic crosstalk and bonding unit" was designed, constructed and then installed into the process.

This unit automatically tests and adjusts the coils for proper cross-talk and phase, and then, while holding them in their pre-adjusted positions, locks the coils relative to the coil form before ejecting them back into the line.

This unit is manually loaded by an operator who has other responsibilities in the area. This operator performs the last manufacturing function on the yoke and then, instead of asiding it back to the moving line, she asides it to the feed conveyor system of the unit. The unit paces itself and removes a coil from the feed conveyor when it calls for one. The yoke and coil then pass through the unit undergoing the various operations previously described. They are then automatically ejected to the line in a prepositioned manner for further processing.



Automatic Crosstalk and Bonding Unit

Today, completely reliable cross-talk and phase settings are continually obtained by automatically locking the coils with respect to the coil form so that they cannot possibly move. Yokes are now automatically permanently bonded and no rejects in the factory or in the field due to cross-talk phase have been encountered.

The result of this good new design control work was a piece of true quality control equipment that was integrated with manufacturing requirements so that defects were eliminated and tens of thousands of dollars in quality costs were saved.

I am sure that I don't need to proceed with any further examples to identify the first of the technologies of the quality control engineer. Now, let's turn briefly to the second technology—the area of *business economics.*

Business Economics

The business economic contribution of the quality engineer has aroused a great amount of management interest over the past year, especially in quality costs directly associated with manufactured quality.

Although there are no formal nationwide studies on the subject, evidence suggests strongly that many businesses have quality cost expenditures representing 8, 10, 12 percent and much more of their net sales billed. In some cases, this means 80, 90, 100 percent and even more, as related to their total direct labor dollars.

You are all, I am sure, familiar with our breakdown of these quality costs into their three components of Failure, Appraisal and Prevention. Cost analysis in these terms suggests that we have been spending our quality dollars the wrong way.

A fortune down the drain because of failures; another large sum to support a sort-the-bad-from-the-good appraisal screen to try to keep too many bad products from going to customers; comparatively nothing for the true defect prevention technology that can do something about reversing the vicious upward cycle of high quality costs and less reliable product quality.

So, the quality control engineer's approach is to establish the right amount of prevention, supporting the right though modest amount of quality planning and analysis to turn this cost cycle downward.

This plainly means an increased expenditure for prevention to bring about reduced failure costs *and* reduced appraisal costs—with the balance of quality cost dollars going to profit.

These increases in prevention are financed by a portion of the savings in failure and appraisal cost: they do not represent net, long-term additions to total company quality cost.

Let's examine what actually does happen cost-wise, in total quality control:

First, when prevention costs are increased, to pay for the right kind of quality control engineering work, a reduction in the number of product defects occurs. This defect reduction means a substantial reduction in failure costs.

Second, the same chain of events takes place as concerning appraisal costs. An increase in prevention costs results in defect reductions which in turn have a positive effect on appraisal costs, since defect reduction means a reduced need for routine inspection and test activities.

Finally, when there is an upgrading of quality control equipment, personnel and practices, an additional reduction in appraisal costs results. Better inspection and test equipment, a general modernization of quality control practices, and the replacement of many routine operators by less numerous but more effective quality control inspectors and testers, have a positive downward pull on the cost of the appraisal function.

The end result is a substantial reduction in the cost of quality, and an increase in the *level* of quality.

Once identified in clean-cut terms of cost economics, he can thus spark a concerted direct effort to work on the problems that have the biggest payoff, and as a result, reduce these high business costs. And incidentally, the selling problem that so many quality engineers feel they have with their managements usually disappears like slush in the hot sun when quality problems are identified in cost terms—rather than in the somewhat more abstract language of the control chart or the sampling plan.

Administrative Aspects

Let's now turn briefly to the third and *administrative* aspect of quality engineering. By this I mean not merely the record keeping that is part of any operation, but also the job of communicating quality knowledge to all the individuals in the company whose actions affect quality. The quality engineer is responsible for reporting on the precise nature of quality progress or the lack thereof in the organization. He is also responsible for teaching the use of quality control procedures and techniques and the training of quality equipment operators.

Let's look at an example of what can be achieved when quality engineers bring this high degree of technological talent to bear in the three areas of product and process, of economics, and of administration. I like to point to a small company that had many trying problems in the quality area and one that was fighting desperately to pull itself out of a loss position.

In 1956, this company started its Total Quality Control program, employing two quality engineers to do the kind of technical work we were discussing.

During the next two years, there was a progressive improvement in product quality and a steady reduction in quality costs. From a high of 9.3 percent to shop cost of output in 1956, quality costs were reduced to 7.4 percent in 1957 and down to 6.8 percent as of the third quarter of 1958.

This downward trend resulted in the following dollar improvements after an investment of $26,900 for prevention effort.

—Appraisal costs were reduced $43,200

—Scrap and rework were reduced $206,800, while

—Complaints were reduced $53,600

In total, this company made a net quality cost improvement of $276,200 in a little less than two years; and its product quality is now looked upon as one of the best in its field.

This kind of quality and cost improvement clearly helped this company to progress successfully to a profit position in 1957, and to continue on to make even greater profits in 1958. In small businesses or large businesses, this same trend is evident in all kinds of products; in chemicals, electronics, missiles and motors—and many others.

The Challenge of Total Quality Control

I am sure you sense that the kind of quality engineering work we have been talking about is truly a new kind of *engineering* work. It involves much more than merely inspection planning work or industrial statistical work or quality troubleshooting.

It is instead a specialized technical activity with a character all its own that calls for a unique combination of skills in engineering principles and practices, in business economics, and of course, in quality control technology, itself.

Building up to a professional level in this work poses bold challenges to three key kinds of men:

—The challenge to you who are the *business managers* is to take advantage of the tremendous business opportunity that product quality provides the shrewd competitor in today's market place.

—To you *quality control managers* the challenge is to come to grips with the total quality problem of your business rather than merely the inspection piece of it.

—To you *quality control engineers* the challenge is to accomplish true engineering work by completely systematizing quality control rather than merely making a career as a statistical analyst of a few individual quality problems.

These are not easy challenges to meet and I do not represent them to be. But my message here is that they are challenges that inevitably *will* be met because they *must* be met. With product quality becoming so important as a motivator for customer purchases, and with quality cost looming so large as a factor in product cost, total quality control is emerging as one of the most potent new tools for improving profitability and productivity in the business kit bag. In my judgment, the aggressively successful business manager and the effectively flexible quality control man *will* quickly meet their respective challenges to make total quality control effective in their companies. And as we move on through the 1960's and total quality control begins to run its course, these quality control actions by the more aggressive will be matched by their slower competitors.

Collectively, the effect will be that total quality control—the next step toward professionalism in our field—will take its rightful place as the newest of the major management functions that make fundamental contributions to those businesses that grow, prosper and contribute to general economic well being. Total quality control in technical action is the future that I see for the quality control man and his function. It is a future that —with proper application of effort—will be a happy and productive one both for him and his career, and for the prosperity of his company.

I am confident that with the enthusiasm that is being demonstrated in this important field, we will develop and implement the economic appreciation, the administrative skills and the advanced technology that are so basic to the "achievement of professionalism in quality control!"

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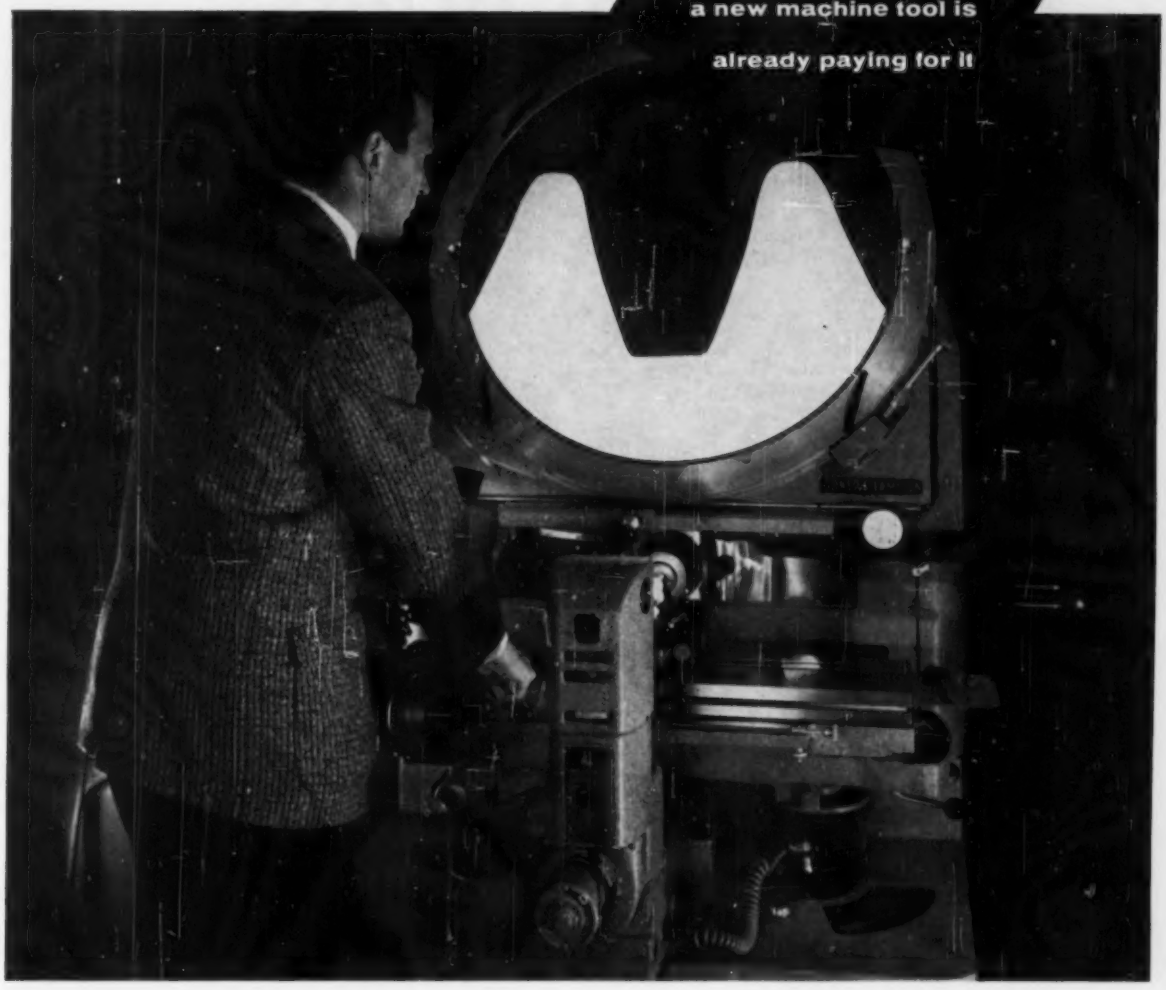

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section briefs

AKRON-CANTON . . . Irving W. Burr, Purdue University, presented "Putting Statistical Methods to Work," at the first meeting. Mr. Burr injected humor into his talk and stressed the role of vastly diversified technologies in the principles of statistics. Whenever there is variation there is a statistical problem. The principles of statistics offer a technique for practical men to do a better job. The use of $\bar{X}$-R Control Charts and principles of Acceptance Sampling are the most useful of the basic tools.

ALBANY . . . Paul Olmstead, Bell Telephone Laboratories, spoke on "Philosophical Implications of Statistical QC," at the first meeting, Sept. 10, at the University Club. The section is anticipating a successful year, which will include a well-rounded program of guest speakers, plant trips, educational programs, and which will end with symposium on Evolutionary Operations May 12.

Officers elected for this year are: D. S. Holmes, chairman; M. Moscinski, vice chairman; M. B. Lindquist, secretary, and P. Paniszczyn, treasurer. Committee chairmen are J. F. Lauritsen, membership; W. Stafford, publicity; E. Bauer, examining; E. Bianco, education, and N. Turner, librarian.

Charles A. Bicking, the Carborundum Co., will speak on "Quality Control in the Chemical Industry," Dec. 10.

ALBUQUERQUE . . . The first meeting was held in the comfortable surroundings of the Southern Union Hospitality room. After a short business meeting C. A. Bicking, the Carborundum Co., spoke on "The Application of Industrial Statistics in Research and Development." Mr. Bicking discussed statistically designed experiments as an aid to individual creativity and made informative comparisons of the various types of experimental designs. The talk was followed by an extended question and answer period, during which the philosophy and theory of designed experiments was explored.

ALLENTOWN-BETHLEHEM . . . Dorian Shainin spoke on "100 percent Inspection—Its Strength, Weakness and What to do About It," at our monthly meeting. There were 35 members and guests present for the dinner and 55 for the technical portion of the meeting in the Sphinx room of the Hotel Traylor.

Our Bob Schin has been doing some talking and traveling of late! For instance, Sept. 12, Bob lent his talents to the Annual Rutger's All-Day conference by presenting a paper on "Can QC Pay Its Own Way?" This paper is a case history on one product line of the Allentown Works of Western Electric Co., where Bob is chief of QC engineering. Then on Sept. 14, 15 and 16, Bob assisted in the 3-Day Management Seminar at Rutger's discussing "Quality Costs."

The section is conducting instruction courses in two different localities this year. "Practice of Quality Control," is being taught in Allentown and the "Basic Course in Quality Control," is being offered in Reading, Pa.

BOSTON . . . Little standing room was available to late arrivals at our Oct. 1 meeting. E. B. Ferrell's discussion of "Statistical Methods in Engineering Design" emphasized the importance of designing not only a product, but its process (also, and simultaneously); and the value of the Shewhart bowl concept and control charts ($\bar{X}$-R) when used at the design stage (the control chart's ability to "tell all" while other, complicated methods, tell only a part of the story). His slides were of actual problems, carefully picked from many projects on which he has worked at the Bell Telephone Laboratories.

At the Sept. 24 meeting of our Merrimac Valley subsection, August B. Mundell spoke on "What Can the QC Engineer Contribute to Industry." The gathering of 50 members and guests met at the "Yankee Doodle" in Lawrence, Mass.

CHATTANOOGA . . . The opening meeting of the Chattanooga section was highlighted by a most informative talk by Wen H. Li from the Chattanooga Nylon Division, E. I. du Pont de Nemours Co. Mr. Li spoke on the "Statistical Design of Experiments." His presentation was excellent and was followed by a lively question and answer session.

In accordance with the Chattanooga section's policy of emphasizing local people, the December meeting will feature a talk by John McClure, Quaker Oats Co. The Chattanooga plant of the company is engaged in the manufacture of animal feeds.

CHICAGO . . . The Chicago section opened the current meeting series Sept. 23 at the Furniture Club of America. Harry Betker and Nels Kans, both of Automatic Electric Co., Northlake, Ill., discussed "Receiving Inspection and User-Vendor Relations," and "QC Techniques as Applied to Small Screw Torque Problems."

A social hour and dinner preceded the excellent evening session presented by Charles L. Matz and John A. Hughes, both of Commonwealth Edison Co. Their subject, "Evaluating the Loading of Transformers by the Load-Factor Method," pertained to methods of statistical QC as applied to checking the loading on approximately 220,000 transformers.

CINCINNATI . . . At the Sept. 16 meeting Jack Gantt, supervisor quality engineering, Jet Engine department, General Electric Co., and a member of the Cincinnati section, spoke on "Blueprints and Measurement Repeatability." Mr. Gantt pointed out that a blueprint tolerance has different meanings to the designer, manufacturer and inspector. In most instances, the tolerance fails to include the inherent variability of the measuring equipment. The "Gantt Repeatability Test" for determining equipment accuracy and repeatability was explained and discussed. It was emphasized that the repeatability test is applicable for determining the repeatability of all measuring types of equipment.

The Technical meeting was preceded by a dinner and coffee talk by Sid Johnson, the Kroger Co. His subject was, "Moon, Dust and Quality." The advancing technology of the Soviet Union was discussed.

Bill Barker, District 8 representative, was a guest at the meeting and discussed ASQC activities.

CLEVELAND . . . The first session of the section Sept. 11 opened with a new feature, timely topic discussion. This is an informal group discussion of some current statistical problem. Dick Shaw, Mallory Battery, led a discussion on "Mil-Std-414 Sampling Inspection by Variables."

The guest speaker at the regular meeting was Commander Glenn G. Estes, Jr., from the U. S. Navy, Buord, Washington, D. C. Comdr. Estes outlined in no uncertain terms the dependence of the national defense program upon continuous top-notch quality in his talk on "Armed Forces and Reliability." Everyone left the meeting convinced that there just was no such thing as second best for the missile and space program.

Due to last minute business commitments a change in the speaker for December has been announced by program chairman, F. C. Leone. The social night speaker will now be Colston Warne, president of the Consumers Union and economics professor at Amherst College at Amherst, N. H. Mr. Warne will tell us in his talk how Consumers Union tests its samples and what problems arise in such testing.

COLUMBUS . . . The first meeting Sept. 16 was a plant tour of the new air-conditioned plant of Industrial Nucleonics. Industrial Nucleonics was one of the pioneers in utilizing radioactive isotopes in their "non-contacting" gaging and control systems. Their accuracy systems might be described as an example of "automated quality control." The large turnout of members and guests thoroughly enjoyed observing radioactive isotopes as a QC tool.

Dec. 10 George Henderson, Redstone Arsenal, will speak on "Reliability Engineering." He will present some practical applications of reliability along with discussing its importance to the nation's guided missile program.

DALLAS-FORT WORTH . . . The first regular meeting of the season was very well attended. James O. Reece, supervisor of environmental testing, Texas Instruments, Dallas, Texas, spoke in the absence of Kenneth W. Davidson. Mr. Reece spoke on "Environmental Testing at Texas Instruments."

This was the first regular section meeting to be held at the Amon Carter airport. A social hour preceded the program. We are looking forward to a good time when the section tours the TEMCO Aireraft Corp. plant, Grand Prairie, Dec. 10.

DENVER . . . New officers are Duncan R. Ackley, Jr., chairman; Ray B. Davis, vice chairman, and Arthur L. Welch, secretary.

The first meeting was held Sept. 24 at the Wellshire Country Club. Forty-eight members and guests were in attendance for a fine dinner and program. Speakers for the evening were W. A. Christian, QC manager of Hathaway Instrument Division, who spoke on "QC by Evolution" and Mark C. Loomer, Hughes Aircraft Co., Tucson, Ariz. Mr. Loomer presented a film on "Reliability of the Falcon Missile."

ERIE . . . James L. Harris, QC manager at Standard Pressed Steel Co., Jenkintown, Pa., spoke on QC and Reliability at the first meeting Sept. 16, at Nesseus Grill.

EVANSVILLE-OWENSBORO . . . A very enjoyable evening was had by all at the Sept. 15 meeting at the Westhaven Gun Club in Evansville. Walter P. Sime, supervisor of QC engineering in the production engine department of the General Electric Co., presented a program on "Quality Costs."

The December meeting will be held Dec. 15 at the Green River Steel Corp., Owensboro, Ky. A tour of the Green River plant will follow the regular monthly meeting.

GRAND RAPIDS . . . The first session of our education program was held Sept. 10, with 22 in attendance. Fifty-two members and guests attended our regular dinner meeting. Brant Bonner spoke on "Evolutionary Operation."

GREATER DETROIT . . . Nearly 250 persons representing all phases of industry attended the 14th Annual Michigan Forum Sept. 12, at the University of Michigan. A summation of all comments would be that this years forum had the finest selection of speakers ever offered at an event of this type. Forum Chairman John Coppola, Vice-Chairman Morris Lightstone, and committee chairman and all committee members should feel that the many hours of work that went into making this forum such a success have been justified.

Plan now to attend "Management Night," Dec. 9, at the Veterans' Memorial Building. The theme of this meeting will be "How Quality Control Programs Reduce Plant Operating Costs." Meeting Chairman Robert Vujovich has made plans for a special tribute to the section members who have attained the grade of "Fellow." Refreshments will be served.

GREATER MUSKEGON . . . More than 21 members traveled to Grand Rapids Sept. 10 to join that section in a joint meeting. Brant Bonner of Dow Chemical Co., spoke on "Evolutionary Operations." Mr. Bonner's talk was of considerable interest to the 50 persons present at the joint meeting.

Emery Gotchall, QC engineer of Zenith Corp., will speak on "QC at Zenith Corp."

HAMILTON . . . Walter Pukalo, Inspection Services Branch, Department of Defense, opened the new season Sept. 17. Mr. Pukalo spoke on "Process Control," and was enthusiastically received. We are looking forward with keen anticipation to our tour of the Firestone Tire and Rubber Co., Hamilton, Ont., Dec. 3.

HAMILTON-MIDDLETOWN . . . John W. Gower, Dayton, Ohio lawyer, gave an interesting and enlightening talk on "Legal Aspects of Quality Control," stressing the important role of QC in reducing the liability of the company to their customers arising from inferior products.

Elmer Robisch, vice control dept., Cincinnati police department, gave an interesting coffee-talk entitled, "Narcotics". In his talk, Mr. Robisch stated that the stronger narcotic penalty laws had greatly reduced the number of dope peddlers and addicts in Ohio.

James M. Barrabee, chief QC engineer, Hoover Ball and Bearing Co., will be the guest speaker at our December meeting. His topic for the evening will be "Planning and Engineering—Prerequisites to QC Success." Mr. Barrabee's experience, both in heavy industry and precision manufacturing, should make for an informative evening.

HARRISBURG . . . The executive committee met Sept. 16 at the Schick plant in Lancaster. The membership committee deserves special recognition for having our section near the top of the ranking according to percentage of renewals.

Our December meeting at the Yorktowne Hotel will be one of the increasingly popular panel discussions. W. C. Birdzell, purchasing agent, Caterpillar Tractor Co., will lead the panel in "Who Establishes Spec Limits." Panel members are: Wm. Bowen, chief industrial engineer, American Chain and Cable Co.; S. H. Sellers, plant superintendent, American Chain and Cable Co.; C. H. Cramer, chief inspector, body division, York-Hoover Corp.; M. J. Spruitenberg, senior engineer, York Division, Borg-Warner Corp.; and W. Young, plant manager, Bearings Co. of America.

HARTFORD . . . The Hartford section is offering four courses: basic statistical QC, intermediate statistical QC, design of experiments and analysis of data, and basic inspection and gaging. Instruction began Oct. 22. Additional inquiries may be directed to Gene Ellis, 100 Belbridge Rd., Glastonbury, Conn.

JOPLIN . . . A three day basic QC training course was given at the Eagle-Picher Plant by D. D. Shelton, Sandia Corp., Albuquerque, N. M. The course was attended by 15 hourly personnel from the QC and production departments.

The monthly meeting was a well planned tour through the North American Rocketdyne plant at Neosho, Mo. A fried chicken dinner at the Hereford House in Neosho was enjoyed by all present. A discussion of the future of rocketry and present rocket motors manufactured at the Neosho plant was held after dinner. An excellent film, "The Wildest Horizons," was shown. The group then adjourned for a very interesting tour through the plant and test site. The group was very fortunate in being able to witness a static test firing of a motor. All arrangements were made by Ned Irvin of Rocketdyne.

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Indiana Governor Proclaims QC Week

"In the industrial life of our Nation, the position of the State of Indiana has from the beginning been based on its excellent products and services," noted Harold W. Handley, governor of Indiana, as he proclaimed Sept. 13-20, 1959, as Quality Control Week.

Governor Handley added that the ready acceptance of the goods and services from Indiana has been enhanced by the constantly high, uniform quality control techniques which have been promoted by ASQC through their endeavor. The future of Indiana is dependent upon the attainment of even higher standards by use of effective QC techniques.

KANKAKEE-JOLIET . . . Twenty-five members and guests were present at the first meeting of the season held at D'Amico's restaurant, Joliet, Sept. 9. After a brief business meeting, during which the new committees were introduced, John Jeffrey, Caterpillar Tractor Co., spoke on "Vendor Quality Rating." Mr. Jeffrey presented many interesting and useful ideas.

The executive committee met at General Foods, Kankakee, Sept. 24, to finalize plans for the management night meeting.

LEXINGTON . . . The monthly meeting was held Sept. 17, at the Lexington Signal Depot. L. Kent Reitz, development engineer, Eastman Kodak Co., spoke on "Coating Paper in the Film Industry," discussing QC applications. We were glad to welcome Bill Barker, Cincinnati, who is now District 8 representative. Bill played a large part in the organization of this section and it was good to hear from him. He gave a report on the French Lick conference on professional activity and went over the Saddoris rules for the benefit of the membership.

The Lexington section is sponsoring a 12 week course in "Fundamentals of Statistics," at the Lafayette Vocational School. This section sponsored courses at Lafayette and the University of Kentucky last fall and as a result of the enthusiasm, the U of K has installed a regular course in statistical QC in its evening class schedule for the fall semester.

LIMA . . . For the fall education program, Richard Peggs and Lloyd Harvey, co-chairmen, have lined up Richard Weaver of Bluffton College to instruct a basic course in statistical QC. Mr. Harvey is presenting a measurement methods course.

LOS ANGELES . . . The attendance at the first meeting Sept. 16 exceeded the June meeting's record attendance by 157. (624 in September, 467 in June). Since no one disputed our claims to a record attendance for a dinner meeting in June, the September record will probably be a total for other sections to shoot for. The credit goes to Jack Lancaster, who contacted vice-presidents (who also attended) of every major military contractor in the Los Angeles area for their cooperation in seeing that General Ben I. Funk, commander of the USAF Ballistic Missile Center, had a large audience.

General Fink's message, "Quality and Reliability Assurance for Ballistic Missiles and Space Vehicles, "concluded with these important remarks to top management: "The survival of our nation depends on our ability to maintain a position of **qualitative superiority. Quality Control** has a vital responsibility in achieving this objective, and to meet this responsibility, top management must fully recognize the expanded role of quality control in assuring the quality and reliability of our weapons. **I urge management to give maximum support to their quality assurance efforts** in the National interest." As a result of this meeting, over 100 requests for membership applications have been received. The drawing power of good speakers for increasing membership in the Society is well worth our extra efforts.

LOUISVILLE . . . A dinner meeting Sept. 21 at Jimmy Lynn's Restaurant opened the 1959-60 season. We were happy to have so many guests at the start of our "100 or Better" membership drive. During the business session we heard that Faye Smith had been elected secretary of the Louisville Engineering and Scientific Societies' Council.

The Louisville section handled transportation for 75 "out of town" people attending the Midwest Quality Control Conference at French Lick.

It was announced that our section will offer at least one QC course this season, probably two.

Pat Dellario presented an interesting educational capsule on "Determination of Sample Size Needed to Find Change in Process Level."

E. Schrock, American Radiator and Standard Sanitary was the evening's main speaker. His excellent talk on "What Makes Tomorrow?" made one realize that most, if not all, great enterprises emerged from failures. It was a new and heartening approach.

METROPOLITAN . . . The Rutgers Conference Sept. 12, was very well attended. Six simultaneous panels were offered, both morning and afternoon. For those responsible for QC programs, an excellent panel discussion on management aspects was conducted. In areas of application, there was a breadth of scope in the field of inspection, electronics, ceramics and chemistry. Also included for the first time were sessions on clinical trials, sensory testing, electronic computers and a full morning and afternoon program covering QC and statistical applications in the field of auditing and accounting.

For the second time our ladies' program was a huge success. Highlights of the program included a demonstration by a representative of Revlon, Inc., on "Cosmetics for the Modern Woman," and color slides of "New World of Ideas in Interior Decorating," by the Celanese Corp.

December 4 and 5—Princeton Conference—place a red circle on your calendars and keep these days open for our conference.

MID-HUDSON . . . The regular monthly meeting was held Sept. 8, at Anchor Inn, Poughkeepsie, N. Y. Marsh Gwynn, Eastman Kodak and ASQC district representative, was the guest speaker. In addition, a panel discussed the functions of ASQC in industry. Five members from this area attended a one day ASQC conference at Rutgers University. They were H. Mirick and R. Ohlson of IBM and L. Bock, J. Wheeler and T. Derose of Daystrom-Weston.

MILWAUKEE . . . The first meeting was held Sept. 28. Max Astrachan of the Air Force Institute of Technology spoke on "Sampling by Variables and Mil. Std 414," an excellent kick-off for the coming year. Fifty-five people attended the session and the buffet supper which preceded it.

Twenty-eight "students" sat in on the year's first training session which was conducted by John Melchior of the Miller Brewing Co., prior to the regular meeting.

The December 14 meeting has been designated as "Ladies' Night." In addition to hearing District 12 representative Art Benscoter talk on "Professionalism," the ladies will be treated to cocktails, buffet dinner, barbershop quartet singing and a movie tour of the Hawaiian Islands offered by one of the airlines in connection with the Annual Convention in San Francisco.

MONTREAL . . . The initial meeting of the season took place at the "Ye Old Molson's Arms" Brewery. Attendance records were smashed as more than 85 quality minded self-styled taste panelists turned out for this function. The question-answer period that followed the plant tour emphasized the interest of our members in QC. Indeed, the QC department at Molsons will be busy for quite a while looking for some of the answers to questions which went unanswered at the time.

MUNCIE . . . The section held the first meeting of the season in September. R. B. Cowin of Kimble Glass gave an interesting talk on "Quality Measurements for Production Standards and Incentive Payments."

NORTHEASTERN INDIANA . . . The section wishes to thank H. V. Dempsey and the Falstaff Brewing Corporation for the successful "get-acquainted" meeting at Falstaff's Hospitality room in September. The highlight of the meeting was a tour of the brewery.

Section members and friends are looking forward to what should be a very interesting and educational innovation at

the December panel meeting. Four QC supervisors from four major industries in Fort Wayne will each present his company's QC program and applications. The meeting will then be thrown open for discussion, with members being invited to ask questions of the panel. Panelists will be: Harold Brenner, QC engineer, General-Electric; Donald Hensel, Operational Analysis, the Dana Corp.; Gideon Statz, control manager, North American Van Lines. The meeting will be at the Fort Wayne Chamber of Commerce, 8 p.m., Dec. 17.

NORTHEAST TENNESSEE . . . The section held a general membership meeting Sept. 8, at the John Sevier Hotel, Johnson City. Panel discussions on Collection of Data, Inspection, Test Methods, Design of Experiments, and Statistical Methods for Process Improvements began early in the evening. Discussions were followed by dinner and a talk by George A. Henderson, chief of reliability at Redstone Arsenal. Mr. Henderson spoke on "Quality Control's Relation to Reliability in the Missile Industry." An executive committee meeting followed and plans were made for educational courses for ASQC members and local industry employees.

The Kingsport, Tenn., Board of Education and Tennessee State Department of Vocational Education, cooperating with the Northeast Tennessee section, have planned two evening courses beginning Oct. 5. The classes will be held semi-weekly for six weeks. Classes are in "Elementary Industrial Statistics" and "Evolutionary Operations." These are two of a five-unit series which has been planned.

OMAHA-LINCOLN . . . The September meeting of the Omaha-Lincoln section was held at Marchio's in Omaha. It was the annual guest night. Chairman E. P. Murphy welcomed members and guests and gave a report of the Mid West Conference at French Lick, Ind., which he had attended. Niles H. Barnard spoke on the history of the ASQC and of the Omaha-Lincoln section. Lane Westmoreland of the Goodyear plant told of his experiences at the statistical QC short course at the University of Michigan and the benefits he derived from the course.

PARKERSBURG . . . Bill Barker, District 8 representative, spoke at the opening meeting Sept. 22. It was a get-acquainted affair, with 40 persons in attendance.

PENSACOLA-MOBILE . . . The first meeting was held Sept. 28 at the Brookley AFB Officers' Open Mess. Guest speaker was B. Berger, assistant superintendent, reliability and engineering services, Western Electric Co. His talk was entitled "Coded Memory Trouble-Shooting Systems."

Mr. Berger's talk was related to the isolation of failure causes through the use of a catalogue of effects and associated test equipment. Failures are introduced progressively throughout a system and the corresponding results on the test equipment are recorded in a catalog. Therefore, given a syndrone, or a group of effects on the test equipment, the resulting failure can be identified by referring to the catalog.

Guest speaker for the December meeting is John Comish, section chairman and statistical analyst in the staff QC office of the Mobile Air Materiel area. His talk is entitled "Defect Per Unit Multi-Level Continuous Sampling." Application and operations of this type of sampling will be discussed.

PHILADELPHIA . . . Congratulations to the Committee and others who made possible the Fourth Annual Symposium which was held at Temple University this year. Besides the speakers from outside sources, two of our section members, Thomas J. Moran and Albert A. Goodman delivered papers.

The regular section meeting followed the symposium at Temple University and was a success with the dynamic S. J. Lorber, chief of inspection and quality assurance, U. S. Army Ordnance, Pentagon, as guest speaker. His talk on "Quality Assurance" helped to clarify many misconceptions about the requirements of the government in terms of quality assurance, as specified in procurement contracts.

All members should look forward to a pleasant evening Dec. 19, when we will hold our annual Christmas social evening at the Germantown Cricket Club. This is your chance to show the little woman where you spend those meeting nights. The affair will cater to the ladies who will each receive a gift and will have a chance to compete for other prizes. For reservations call Mary E. Wolcott, SA 7-1500.

PITTSFIELD . . . The new season opened Sept. 23 with the following officers: Richard F. Powell, chairman; William A. Noble, vice-chairman and program chairman; Joseph J. LaMountain, secretary; Joseph A. Trowbridge, treasurer; Robert Tarver, Sr., education; Joseph A. Batease, membership; David P. Antos, arrangements; Wilfred J. Johnson, publicity, and Douglas A. Slingerland, Saddoris award and New England Conference representative.

Rocco L. Fiaschetti, Ansco Div., General Aniline and Film Corp., was guest speaker. He placed emphasis on the fact that each member should take an active part in ASQC matters in order to further themselves and the Society. His speech was informative and interesting since the past, present and future functions of the Society were well explained.

Mr. Powell presented to Fred Hartwell, George Lyman, Lawrence Spooner and Douglas Slingerland, all past chairmen, appropriately engraved tie bars.

An intermediate course "Statistical QC" began in September at the Pittsfield high school with 20 in attendance. Leonard Kroll of the Peter J. Schweitzer Co., is the instructor.

PORTLAND . . . Oct. 6 was management night, with the subject, "Who Sets the Quality Level?" Members and managers were divided into four groups and given a limited time to discuss the subject. Group moderators were Herman Karlebach and Casey Hokestra, Omark Industries; Ray Vanderzanden, Sawyers, Inc.; Don Hancock, Jantzen, Inc.

RACINE . . . Our first dinner meeting of the new season was held at Wergeland Society Hall, Sept. 17, and proved to be very successful. Myron Wilson, director of QC, Collins Radio, Cedar Rapids, Ia., spoke on "QC at Collins Radio."

Officers for the coming year are: chairman, Frank Milaue, Racine Hydr. & Mach., Inc.; vice-chairman, E. W. Solum, Hamilton Beach, Inc.; corresponding secretary, T. F. Brisgal, John Oster Mfg. Co.; treasurer, E. F. Mahnke, Racine Hydr. & Mach., Inc., and recording secretary, H. Kirsten, John Oster Mfg. Co.

Tentative plans are being made for a mixed social this year, possibly a dinner-tour of one of Milwaukee's famous breweries.

RHODE ISLAND . . . Two council meetings were held in September, mainly to complete arrangements for our education program. Classes began Sept. 30, with a total enrollment of 50—the largest ever registered. Our hats off to P. K. Moffat, education chairman, for a fine start.

Our September meeting, with Jeremiah P. Murphy, QC director of Naval Materiel, Boston, Mass., had an overwhelming attendance of 83. He spoke on "Government and Field Inspectors' Problems in the Vendor—Vendee Relationship" and "Aspects of the Government Assurance Program."

ROCHESTER . . . The gaging and measurement sub-group had as speaker Sept. 29, W. J. Stolp, Eastman Kodak Co. Mr. Stolp showed a large number of remarkable color slides which illustrated what can be done with optical gaging.

The food and beverage industries sub-group and guests toured the Continental Can Company's Syracuse plant Sept. 18. A large number of Continental people, headed by John Zachai, plant manager, guided the visitors. Films also were presented. A business meeting was held, and two TV stations and the newspapers picked up the story. Cocktails and dinner were served at the Airways Inn. The host organization at dinner was the Hazel-Atlas Division. Our thanks to Continental and Hazel-Atlas and all the individuals who helped make our visit so informative and entertaining.

Macaulay Receives 2nd Annual RIT-SQC Award

Donald Macaulay has been presented the 2nd Annual Rochester Institute of Technology—Statistical Quality Control award for outstanding contributions to quality control in the graphic industries. He received the award in June at the closing banquet of the 9th Annual Seminar for Quality Control for the Graphic Industries at the Rochester Institute of Technology.

The award, a sterling silver bowl, was crafted in RIT's school for American craftsmen by famed Danish silversmith Hans Christensen. The citation on the bowl reads, "To Donald Macaulay for Outstanding Contributions in SQC for the Graphic Industries 1959." It was presented by Byron G. Culver, head of RIT's printing department.

Mr. Macaulay is president of Paper Quality Control, Inc., Chappaqua, N. Y.

The first RIT-SQC award was presented last year to B. E. "Ted" Sooy of the Wolverine Carton Co.

SACRAMENTO . . . The first meeting was held at Sam's Hofbrau Sept. 29. James Smith, chief, weapons and components division, QC office at McClellan AFB, was the speaker. His topic was the Air Force Calibration Program. Mr. Smith has had 27 years of experience in the aircraft industry, which includes aircraft maintenance, manufacturing and quality control. Mr. Smith described how the calibration and certification precision measurement equipment standards in the Air Force tie in with the National Bureau of Standards. He discussed the recognized needs for calibration equipment, and the training of people to calibrate test equipment to support the missile and weapon system program. In addition, Mr. Smith discussed the surveys that were conducted at the contractors facilities to determine accuracy and adequacy of calibration standards, and the compatability of AF and private industry standards required to meet the needs of our missile and weapon systems.

ST. CHARLES . . . The first meeting was held Sept. 15 at the Club Arcadia in St. Charles, Ill. LeRoy Wickstrom of the Illinois Institute of Technology spoke on "Industrial Problem Solving." The pre-dinner seminar, so popular last year, has been extended to precede each regularly scheduled meeting this year. The first of the series concerned "Lot Plot Sampling."

The section is currently conducting a basic course in QC techniques for the third consecutive year. An intermediate course in sampling techniques will be offered for the first time next spring.

Otto U. Roberts

It is with deepest regret that the Racine section reports the sudden passing of Otto U. Roberts, a member of ASQC for many years and our '59-'60 vice chairman.

ST. LOUIS . . . The St. Louis section's curriculum in statistical QC is off to a good start with 40 enrolled in the basic course and 8 in the advanced course. The intermediate course will be offered in the spring.

The St. Louis Conference originally scheduled for October has been postponed until later in the fiscal year.

The Illinois sub-section has gotten off to a good start with a membership of 29 and a good program planned for the year.

Harvey Barnett delivered a paper "Introduction to Evolutionary Operation," at the 14th Annual Michigan Forum, and at the American Chemical Society annual meeting in Atlantic City.

SAN ANTONIO . . . Kenneth W. Davidson, QC branch manager, Texas Instruments, Inc., Dallas, Tex., spoke on "Quality Assurance in the Semiconductor Industry," at the Sept. 22 meeting. This paper included QC methods, product evaluation and benefits, and reliability engineering and its importance. Mr. Davidson's paper was well received in view of the lively discussion period that followed. This meeting officially opened the new season for the section, and with a full slate of speakers through May 1960, we can expect another successful and informative season.

Our annual management night is slated for Nov. 24, with Jack Gantt, General Electric Co., as the guest speaker. The section is anxiously awaiting this event.

SAN DIEGO . . . The September meeting proved to be quite interesting as the "Subcontractor's View of the Primes," was laid bare with no holds barred before a full house attendance. One major problem area which was pointed out by the panel members was that all primes should be more specific in specification details as to exactly what was desired from the subcontractor. The discussion which centered around the "box and crate builder" aspects of shipping hardware was extremely interesting and enlightening; this area being so often overlooked in the overall QC picture. The need for standardization of special process requirements among prime contractors was also highlighted. An "Orchid" to Rohr Aircraft for a most interesting and successful meeting!

An interesting program is on tap for the Dec. 14 meeting at the Lafayette Hotel. The program is being sponsored by R. H. Gilliland, QC Manager, Convair, San Diego, and will cover the area of "Project QC Test Planning." A. C. MeMaster, QC Manager, Convair, Pomona, will be the feature speaker.

Several section members attended the bull fights in Tiajuana, Mexico, just 15 miles south of San Diego, recently and had a real exciting time of it especially when one of the bulls attempted to join the group. One member was heard to say 'ere he disappeared, "Damn the laws of probability—this is for real."

SOUTH TEXAS . . . The executive committee held its first meeting in September and under the direction of Chairman A. R. Stark, Humble Oil & Refining Co., planned the year's activities.

Plans for future courses in statistical QC are now being formulated and details will be announced as soon as possible.

Interested persons should contact Robert B. White, Southwestern Electronics Co., Houston, Tex., concerning activities and membership in the South Texas section.

The Third Annual Technical Conference of the Chemical Division was held at the Shamrock Hilton Hotel, Houston, Tex. Our section enjoyed being host for this occasion. Jerry Moyer, general chairman of the conference committee and all his capable committeemen, deserve our thanks and congratulations for a top notch affair. We in the Gulf South were honored to have with us so many well known men highly skilled in the arts. It was a stimulating affair.

SOUTHERN CONNECTICUT . . . A well-attended outdoor barbecue, with all the fixings from chowder to watermelon, was held Sept. 23, at Eichner's Grove in Bridgeport. Section chairman Dave Albert introduced the officers and committee chairmen and reviewed the program for the coming year.

SYRACUSE . . . For the second year a program brochure for the coming season has been prepared and distributed to members. The brochure contains a picture of each speaker and a brief biography and description of his proposed speech. As an innovation this year the mailing list was increased to include all firms represented in the Manufacturers Association and other interested persons. A letter was sent along with the brochure stating our aims, mentioning our education program, and offering aid upon request.

The first QC classes at Syracuse Central Technical high school started in September with an enrollment of 15 in basic concepts of QC, and 14 in advanced applied industrial statistics. For the first time the advanced course is being taught as a full-year course.

Martin A. Brumbaugh was the guest speaker at the afternoon sessions of the 14th Annual Michigan Forum. His topic, "The Great Experiment," dealt with what industry has gained by the introduction of statistical methods to manufacturing operations.

Robert M. Hofstead was a moderator at the clinical session of the all day conference on QC and statistics in industry at Rutgers University.

TOLEDO . . . Harmon S. Bayer spoke on "Cost Reduction Through Quality Control," at the first meeting, which was well attended. The talk touched off some spirited discussions.

The name chosen for our monthly newsletter, to be distributed to section members, is "Qualiteer."

Plans have been made for the annual Christmas party, featuring a cocktail hour, buffet dinner, and fun. The Town and Country room at the Hotel Secor has been reserved December 12, for members and their wives.

TORONTO . . . Everyone who attended our first meeting Sept. 9 expected to have an interesting and informative evening and it is certain that no one was disappointed, for our speaker was none other than that distinguished craftsman of the art, S. P. Zobel, senior engineer, QC branch, The Carborundum Co., Niagara Falls. His explanation of QC and how it works was detailed and complete and made an excellent introduction to a new season.

Forty-four persons attended an excellently arranged plant tour Sept. 23, given by the courtesy of our hosts, P. L. Robertson Manufacturing Co., Ltd., Milton, Ont., at which Fred Meitz, manager of manufacturing and a member of our section, acted as MC. The party was conducted through the plant in small groups by various members of the QC department. On completion, refreshments were served and an explanation of the control charts and methods used in the plant was given by the QC supervisor.

In accordance with the ASQC policy of using our own talent whenever possible, one of our popular and industrious section directors, M. J. (Mike) O'Callaghan will be our host at the University of Toronto Dec. 2. His subject will be "Tests for Significance."

TUCSON . . . The Tucson section is looking forward to a visit from such notables as Leon Bass, General Electric Co., Capt. J. T. Lay, QC division director, Bureau of Ordnance, U. S. Navy, and Frank Caplan Jr., Westinghouse Corp., during the current season.

All meetings this year will be dinner meetings and all will be held at El Conquistador Hotel in Tucson.

Major Donald F. Crocker, USAF, Commander, Field Maintenance, Davis-Monthan AFB, spoke on "Qualified People for a Quality Business—The Strategic Air Command," at the September meeting. He also brought a movie demonstrating the Air Force system of getting product quality performance feedback information to the supplier.

Officers elected last November when the section was chartered will continue in office through the current season. They are Mark Manning, chairman; Joe Loesch, vice chairman; W. J. Anderson, treasurer, and Ella Seofield, secretary. The section is not planning a December meeting but is looking forward to hearing Leon Bass, ASQC Jr. Past President, Jan. 21.

UTICA . . . The monthly general meeting was held at the Hotel Hamilton Sept. 15. Warren Purcell was guest of honor and gave a very interesting talk entitled, "Who Controls Quality—And How?" The group was evidently quite stimulated by Mr. Purcell's comments, judging from the discussion that followed.

A new feature of the monthly meetings was inaugurated by having the first pre-dinner speaker from the section area. In order to stimulate more local interest, E. Heinemann, General Electric Co., spoke on "What Materials Group Expects from QC." Many of those present were made deeply aware of the intimate support that QC must provide for materials procurement groups.

WASHINGTON, D. C. . . . "Reliability and Statistical QC," was the topic of the director of reliability and statistics, Booz Allen, Applied Research, Bethesda, as he spoke to 53 persons at the opening meeting in September at Rich's.

Mr. Herd pointed to areas in industrial concerns where controlled reliability programs have proven profitable, some of the ensuing problems, and some of the benefits.

Juding from the printed annual program which has been mailed to members, this season promises to be a stimulating one for section members and guests.

WESTERN MASSACHUSETTS . . . The Sept. 15 meeting, a plant tour and cook out at the Strathmore Paper Co., Woronoco, Mass., was attended by 42 members and guests. The inspection trip was informative and the clam chowder, steam clams and steak were a delight. Maurice Blow of Strathmore is deserving of plaudits for doing a fine job at arrangements. The basic course sponsored by this section and the Massachusetts University Extension is off to a flying start. At the first session there were 60 registrants.

Robert Mitchell, International Latex, our December speaker, is a QC man who is now heavily involved with production as a manager. It will be of more than usual interest to obtain his views on the quality function now that he is in the production end.

WESTERN ONTARIO . . . A panel discussion, "Production Views Quality Control," was a feature of the first meeting Sept. 23 in the amphitheatre, Chemistry Building, University of Waterloo. Tom Ryan was moderator.

The following are some of the comments by panel members:

Jerry Sequin, production foreman, tires—It is agreed, QC does reduce errors and costs, but the system is only as good as the people using it. Our biggest arguments are on what is an acceptable finish.

Charles Donohue, superintendent, buttons—Increasing demand for greater productivity means increased control of product quality at all stages. Due to consumer requirements, dimension is not a problem but final finish is.

Russ Smith, quality control, rubber products—People or consumers buy on appearance, regardless of what is said by production to the contrary. A functioning product could be accepted by the public, but if appearance is slightly shabby or if it looks shopworn it looses sales appeal.

Don Watson, quality control, foundry products—How do we make a product for customer acceptance? By using a statistical approach to the production problem and clearly defined limits to the engineering specification, regardless of the dimension or finish requirement.

Moderator Tom Ryan—In summing up, production people agree with the QC function; hold some agreement with the selling organization as to definite limits on product finish; maintain that supervisors should develop pride of product; quality must be built into a product, can't be inspected into it; supervisors should motivate their employees to make products to quality standards; that with the making of a good product, job satisfaction is the result; finally, communication by supervisor to operators to insure proper understanding of quality will result in a better product.

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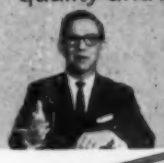

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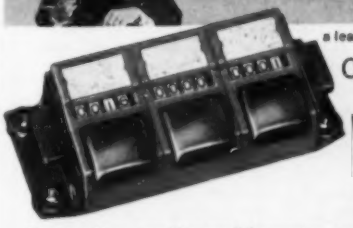

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WINNEBAGO . . . Richard Roberts, Marathon Division, American Can Co., discussed "The Method of Steepest Ascent," during the training session before the first meeting Sept. 21 at the Elks' Club, Appleton. The speaker for the meeting, Harmon W. Bayer, QC consultant, Detroit, spoke on "Cost Reduction Through QC Methods."

WORCESTER . . . Sept. 17 the section opened the new year with a very interesting and informative tour of the Reed Rolled Thread Co., Holden, Mass. After the tour, members and guests adjourned to Nick's Grille for refreshments and dinner. After the dinner, section business was transacted and a movie entitled, "QC in Electrical Wires," was shown. This movie was produced by Suprenant Manufacturing Co., W. M. Land, Jr., conducted a discussion following the movie.

The section is privileged to have John F. Occasione, U. S. Steel Corp., to speak on the metals industry at the December meeting. Mr. Occasione is staff metallurgical engineer in the American Steel and Wire Division of the U. S. Steel Corp., Cleveland, Ohio. He is also a fellow in the ASQC. This meeting will be held earlier in December to avoid the holiday season.

YOUNGSTOWN . . . Leon Bass, Jet Engine Division, General Electric Co., was the main speaker at the first meeting of the Youngstown section. Mr. Bass is past president of the ASQC and former chairman of the Electronics Division. Members and guests from Mahoning and Sherango Valley industries heard Mr. Bass explain that properly applied statistical QC can make a good engineer better, and, when properly understood, will make American engineers more advanced than their Soviet counterparts. Section chairman Paul Belter presided at the business meeting. Ronald White of the G. E. Trumbull Lamp Plant here introduced Mr. Bass. We were very pleased with the large attendance and the interest shown during the question period. Members were encouraged to "bring a friend" to the next meeting.

SIGNIFICANT DIFFERENCES

. . . Akron-Canton—Two members have been promoted by the Timken Roller Bearing Co. **Joe Selby** to quality manager for the domestic and international division, and **Bob Dorn**, our section chairman, to chief inspector for the Canton and Gambrinus plants.

Bud Bedford, section vice chairman, is conducting a course in basic statistical QC which is jointly sponsored by the section and Akron University.

. . . Allentown-Bethlehem—**Don C. Snyder**, formerly of the Harrisburg section, has transferred to our section. He is now employed as QC engineer at Western Electric's Laureldale works. Likewise, **Charles Pratt** has transferred from the Albany section since becoming a reliability engineer in the same plant. **Jim Caton** has been moved up from Western's Winston-Salem works to become department chief of QC and inspection methods at the Laureldale works. **Ken Stephens** has been appointed to a three year term on the ASQC committee on education and training, and is chairman of a subcommittee to prepare an "Examination for Certification." He attended a meeting of the committee at the Manger Vanderbilt Hotel in New York City Sept. 21.

. . . Boston—**Harold E. Grant** has moved from QC technician to assistant inspection foreman at Clifford Manufacturing Co., Waltham, Mass.

William E. Grady has advanced from QC supervisor to QC manager, Carter Ink Co., Cambridge, Mass.

James C. Bognore, from QC supervisor to material review supervisor, aircraft accessory department, General Electric Co., Lynn, Mass.

Edgar Wimpy, from CBS-Hytron, to CBS-Electronics, Danvers, Mass., as marketing research manager.

Harry L. Wildasin, from QC director to director of QC and laboratories, H. P. Hood & Son, Boston, Mass.

George H. Kay, to National Co., Inc., Malden, Mass., as foreman of QC electrical and environmental test and inspection department.

. . . Cincinnati—**Nicholas Frischherts** has been listed in the "Who's Who in Engineering" for 1959.

Earl Niceley has accepted a position with the General Electric Apparatus Div., Cincinnati, Ohio.

Bob Bescher, enrolled student member, has been accepted by the General Electric Co., manufacturing training program. The program consists of six 6-month training-work assignments and outside class work. His first assignment is in purchasing, Jet Engine Department, General Electric Co., Evendale, Ohio.

Bill Eilrich and **Bill Barker** are instructors for the QC course being given to trainees in the General Electric Co., manufacturing training program.

. . . Cleveland—**John Occasione** has been advanced from staff metallurgical engineer, practices and process controls, to assistant chief metallurgical engineer of the American Steel and Wire Division of the U. S. Steel Corp. John is a Fellow, held the office of chairman of the Cleveland section, and is now representative of District 7.

Fred Russell, formerly with Chrysler Corp., Twinsburg, Ohio, is now chief inspector at Weatherhead Co., Cleveland.

All members bid goodby to **Dick Shaw**, who is now working for IBM, Endicott, N. Y. Dick formerly worked for Mallory Battery, Cleveland.

Program chairman **Fred C. Leone**, Case Institute of Technology, presented a paper, "Modern Uses of Linear Regression," at the recent Midwest QC Conference, French Lick, Ind.

. . . Evansville-Owensboro—The training program in basic QC sponsored by our section began Sept. 22 at North high school. **Don Ortberg**, senior QC engineer, Mead Johnson & Co., is the instructor.

. . . Greater Muskegon—**Ray Porter**, QC manager of Muskegon Piston Ring, has announced that he is being transferred to the firm's sales office in Detroit. Ray has been the backbone of the Greater Muskegon section, and upon his departure from this area will be greatly missed.

. . . Harrisburg—The following men have been promoted to the indicated positions at the P. H. Glatfelter Paper Co.:

Olin Hyde, to chief of the QC engineering section.
Ken Whisler, to chief of inspection and testing.
Cleo Bartner, to inspection foreman.
Don Yateman, to supervisor of paper research.

. . . Indianapolis—**Arthur Bender**, Jr., QC engineer, Delco Remy Division, General Motors Corp., Anderson, Ind., is a contributor to the completely revised "Tool Engineers' Handbook," second edition. The handbook is a technical reference work published by the American Society of Tool Engineers, Detroit, as an aid to chief engineers, planning heads, manufacturing executives and others connected with the manufacturing industries.

Harold T. Long, Purdue '59, has taken a post as product engineer, Western Electric Co., Indianapolis works.

Know your new committeemen: placement—**Keith Ross**, Columbus Process Co., and **Irving Burr**, Purdue; Saddoris Award—**Latham Breunig**, Eli Lilly; scrap book and historian—**Keith Mullen**, Allison Division GMC.

Robert W. Aamoth, from Delco Radio, Kokomo, to AC Spark Plug, Milwaukee.

More new committeemen: arrangements and reception—Ted Meserve, Chrysler Corp.; membership and attendance—Marq. Ransom (chairman), Diamond Chain, and Fleta Jonassen, Cummins Engine; and section examining—Charles Hicks (chairman) Purdue, George McDermott, Delco Remy, and Henry Jacobson, Sutherland-Jacobson Associates.

New Government Publications

Readers of *Industrial Quality Control* will be interested to know that two documents published by the Office of the Assistant Secretary of Defense (Supply & Logistics) have been made available recently to quality control personnel in Government and industry.

A new Department of Defense Inspection and Quality Control Handbook H-107, "Single-Level Continuous Sampling Procedures and Tables for Inspection by Attributes," is available for purchase from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., (price—55 cents). This publication is a companion document to DoD Handbook H-106 on multi-level continuous sampling plans which was published last year.

The second document recently published is revision B to Military Standard 105, "Sampling Procedures and Tables for Inspection by Attributes." The wording of this well-known Standard has been revised to permit DoD suppliers to perform the sampling inspection procedures per MIL-STD-105, required by many specifications and other contractual documents prior to submission of their supplies to the Government for verification inspection and acceptance. Other minor revisions of a technical nature were also included in MIL-STD-105B. This publication is also available for purchase from the Superintendent of Documents for 40 cents.

. . . Lima—**Alan Klemm** has been promoted from QC analyst to head of the laboratory, Ford Motor Co's Lima Engine plant.

. . . Los Angeles—**H. D. (Dick) Hill,** Autonetics, was recently promoted to chief of the quality and reliability data center. Dick is also planning two excellent plant visitations for the section, to take place within the next three months.

Harrison Ley, formerly of Servo Mechanisms, is now QC director for the Inet Division of the Leach Corp.

Richard Speed recently became the new QC director for the Hallamore Electronics Division of the Siegler Corporation in Anaheim.

Fred Peck, Hughes Products, was nominated recently to be the first chairman of the new Orange Empire section, being organized in the Orange County, Calif., area.

. . . Montreal—**Geo. S. Williams** is now with Sperry Gyroscope Limited of Canada.

. . . Northeastern Indiana—**Leonard A. Erickson** recently retired from General Electric Co., Fort Wayne. Mr. Erickson was manager, QC, general purpose motors, at the time of his retirement. He had been with the company 43 years, most of the time in QC and allied fields. He has been a charter member of our section of ASQC.

. . . Northeast Tennessee—**James W. Thompson,** program chairman, with **James O. Cook** and **Minter Haynes,** education committee members, are currently presenting a series of five hour courses in "Lot Acceptance Sampling." The courses are presented to Raytheon-Bristol employees at the Raytheon plant. All of the instructors are employed at Raytheon.

Ed Gustafson, Tennessee Eastman, attended the ASQC Chemical Division's Third Annual Conference in Houston, Tex., Sept. 24-25.

S. A. Murray, Tennessee Eastman, enrolled for the QC conference at the University of Alabama Oct. 15-16.

James A. Mitchell, Tennessee Eastman, was guest speaker at the Charleston, W. Va. section meeting Sept. 17. Mr. Mitchell's subject was "Accuracy and Precision of Industrial Tests and Analysis."

. . . Pensacola-Mobile—**Carl M. Jones,** Mobile, Ala., was promoted to executive vice president of the Kahn Manufacturing Co.

J. F. Brawner, a QC engineer at Chemstrand, has been transferred from the Pensacola plant to Greenwood, S. C.

D. H. Dannheiser, Chemstrand, vice chairman of the Pensacola-Mobile section, has been transferred from the QC methods group to staff engineer in the analytic development group.

E. D. Remy, QC supervisor, Chemstrand Corp., will present a paper on "The Scope of Quality Control," at the QC Conference at the University of Alabama in October.

. . . Pittsfield—Recently promoted at the General Electric Ordnance Dept.—**Lawrence W. Spooner,** to manager, quality system planning and manufacturing reliability, and at the Warren Wire Co.—**Joseph A. Batease,** to QC foreman.

. . . St. Charles—**Ralph von Osinski** has been promoted to QC manager of the Elgin, Ill., division of the Chicago Rawhide Co. Our congratulations to Ralph.

We welcome **David Fyffe,** newly appointed QC manager of the General Electric Co.'s De Kalb, Ill., plant. Dave was formerly associated with GE at Murfreesboro, Tenn., as the plant QC manager.

. . . St. Louis—**Joe Movshin** has gone into business for himself as consultant. His specialty is reliability, industrial engineering, and QC for small and medium-sized businesses.

James H. Batchelor has just had his "Operations Research —An Annotated Bibliography," published by St. Louis University.

. . . San Antonio—**R. W. Worrick,** junior past chairman, recently returned from French Lick, Ind., where he attended a three day conference of the 14th Midwest QC Conference, of ASQC, Sept. 14-16.

. . . San Diego—Several members of the San Diego section are now associated with the recently established Convair-Astronautics ICBM (Atlas) "Product Support" activity. This new activity is concerned with depot type operations whereby logistic support is rendered to the Atlas ICBM program as well as new ICBM base activations.

Members now associated with the product support activity are as follows:

Walter A. Dibblee, Jr., from deputy chief USAF QC division Convair-Astronautics (main plant) to chief of USAF QC branch, Convair-Astronautics Depot Division.

L. I. Medlock, from QC administration, Convair-Astronautics (main plant) to chief of QC product support center.

Russ De Long, from Humphrey, Inc., to product support quality control.

Reggie Sanchez, from Convair-Astronautics (main plant) QC administration to product support quality control.

R. B. Kalanquin, from Convair-San Diego QC to product support quality control.

Herb Mishler, from Convair-Astronautics (main plant) QC to product support quality control.

. . . Tennessee—Two of our members, **Eric Johnson** and **Robert McMillan,** attended the Third Annual Technical Conference, sponsored by the Chemical Division in Houston.

. . . Toronto—The section notes with pleasure the promotion of one of our veteran members and guest speaker on a number of occasions, **J. K. Ronson,** QC director, Ford Motor Co., Toronto. He has been appointed general manager, Ford Motor Co., Oakville, Ont. Lots of luck in your new position, Jim.

Planning for our 1960 all day forum is almost finalized and a banquet speaker for the event has already been arranged.

. . . Tucson—**Bent G. Trier** has transferred from Hughes Aircraft Co. Tucson, to Lockheed at Sunnyvale, Calif., and the San Francisco section.

The section is again co-sponsoring a series of "Practical Statistical QC" classes at Hughes Aircraft Co., Tucson, beginning Sept. 28 and running through Dec. 14.

. . . Western Massachusetts—**Alan Donnelly,** membership chairman, is also sales advisor to Enfield-Somers Junior Achievement being sponsored by Bigelow-Sanford Carpet Co. There will be 18 boys and girls who will manufacture and sell at least two products.

. . . Worcester—Two of the Worcester section members are currently teaching QC courses at Worcester Junior College. **Art Pingalore** is teaching the fundamental course and **Axel Sternlof** is conducting the advanced course. Art is publicity chairman and Axel is section chairman.

Art Pingalore is serving his second year as secretary of the Worcester Engineering Society.

On Sept. 30, the chairman of the Worcester section, **Axel U. Sternlof,** ASQC Fellow, retired from his position as Division QC engineer at the American Steel and Wire Division of the U. S. Steel Corp., in Worcester. The evening before his friends in management entertained him at a retirement party at the Paxton Inn. Axel is presently spending his spare time remodeling his summer camp in North Brookfield. Although he has retired from industry we are sure his interest in QC and the local section will not diminish.

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What's New?

ROY A. WYLIE, *Editor*
Ampex Corporation

P-11-5—Leeds & Northrup Company, whose Anthony Pattern Wheatstone Bridge has served as a laboratory and production standard for accurate d.c. resistance measurements since 1903, is now offering a completely new and improved 4232-B High Precision Guarded Wheatstone Bridge. The old bridge's plugs and blocks have been replaced with enclosed rheostat dials and high-quality selector switches. The result is faster and easier operation by merely turning the dials and taking a direct reading from the windows above each dial. The new bridge provides complete guarding which eliminates errors caused by adverse humidity conditions and resulting leakage currents. This assures accuracies of ± 0.01% up to 1 megohm and ± 0.02% up to 100 megohms. The bridge has wide measurement range—from 0 to 11,111 megohms—or 100 times greater than the Anthony Pattern bridge's range. Resistors may be tested with the new instrument at full battery potentials up to 100 volts, in accordance with the maximum values permitted in military specifications. Guard terminals are also provided so that the bridge guard sustem can be completed with a guarded d-c bridge power supply and a guarded detector. With each instrument L & N supplies a certificate based on its own standards which are certified at intervals by the National Bureau of Standards.

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P-9-12—Available in most standard fluorescent and slimline sizes, the new "Koolorated" pure white fluorescent lamp blends a precise balance of all colors in the visible spectrum that are present in natural outdoor daylight. This accurate blending of prismatic colors eliminates color distortion and provides a constant standard of the most nearly perfect illumination possible for proper evaluation of colors and textures. An extensive field testing program has resulted in an assigned rating of from 16,000 to 18,000 user hours for this new, pure-white lamp. This unusual life expectancy offers exceptional savings in labor alone, wherever lamp replacement cost is a factor. A written two year free replacement guarantee is given with each tube.

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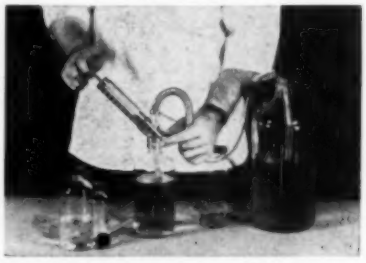

P-11-10—To meet the need for an easy method of sampling where contamination must be avoided and where highly-corrosive liquids are involved, the W & W Manufacturing Company has developed a versatile, light-weight vacuum pump known as the "Golden Thief". The Model D handles liquids up to the consistency of syrup, as well as powdered solids that have a tendency to "slump" or seek their own level. Lift of the pump is approximately 25 feet of water at sea level. Material passes through sanitary tubing from the sampling source directly to the sample container—never coming in contact with any part of the pumping unit. Motive power is provided by the vacuum created in the sampling container on the up-stroke of the pump handle. Easy cleaning and low maintenance are additional advantages listed. The Model D "Golden Thief" is available in both

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stainless steel and aluminum. Since parts are inter-changeable, the pump can be furnished with stainless steel base and aluminum body or any combination to meet individual needs. The equipment fits neck-opening sizes from 22 mm. to wide-mouth mason jars, but can be used for transferring materials to smaller containers.

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P-11-7—How clean is clean? With the Branson Model CM-1 Cleanliness Tester, you now can tell. Developed by the Graham Research Laboratories of Jones & Laughlin Steel Corporation and built by Branson under a licensing arrangement, the new tester makes it possible to assign numerical values to surface cleanliness where non-bonded soils are involved. For example; the CM-1 will measure smut residue after pickling of steel. In addition, the tester may be used to evaluate detergents and oils used in cold mills; annealing furnace performance; and efficiency of electrolytic and alkaline cleaning lines. Plating, lithographing, organic coating, adhesive bonding—are typical applications where absence of foreign matter is vital to the success of the operation. The tester has a linear scale from 0 to 1000, where 1000 indicates absolute cleanliness. Accuracy of one part in a thousand is made possibly by a ten-turn potentiometer in the balancing circuit. The test is more exact than methods formerly used, such as the water-break and wipe tests. Although these provide a rough indication of freedom from oils, they do not offer a means of determining the amount of finely divided soils adhering to a surface. Testing involves two steps: 1) Soil is removed from the surface under test with transparent, pressure-sensitive tape, which is then affixed to a 25 x 75 - mm microscope slide. 2) Optical density of the composite (tape, oil, and slide) is measured by the tester, which is actually a densitometer designed specifically for that purpose. Readings are direct and give a numerical value for cleanliness.

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SECTION CALENDAR (NOVEMBER 25—DECEMBER 31)

SECTION	DATE	PLACE	TIME	SUBJECT	SPEAKER
Akron-Canton	Dec. 17	Iacomini's	8:00 p.m.	Tests for Significance	Fred C. Leone, Case Institute, Cleveland, Ohio
Albany	Dec. 10	Hot Shoppe, Northern Blvd. & Shaker Rd., Albany	6:30	QC in the Chemical Industry	Charles A. Bicking, The Carborundum Co., Niagara Falls, N. Y.
Baltimore	Dec. 15	Baltimore Memorial Stadium	8:15	Use of Regression Analysis in Budget Control	M. J. O'Callaghan, British American Oil Co., Toronto, Ont.
Binghamton	Dec 8	Joint Meeting with the Southern Tier Technical Society		What's Behind Experimental Design?	Richard Bingham, The Carborundom Co., Niagara Falls, N. Y.
Boston	Dec. 3	MIT Faculty Club	6:30	Techniques of Product & Process Control	W. S. Hertzmark, Raytheon Co., Newton, Mass.
Buffalo	Nov. 30	Continental Inn, Town of Tonawanda, N. Y.	6:30	Management of Statistical QC in the Smaller Industries	Allin P. Deacon, Deacon & Associates, Brantford, Ont.
Chattanooga	Dec. 8	Panoram Hotel	6:30	How We Control Quality	John M. McClure, Quaker Oats Co., Chattanooga, Tenn.
Cincinnati	Dec. 16	Engineering Society Building	8:00	Application of Statistics in Pharmaceutical Manufacture	R. M. Hofstead, Bristol Laboratories, Syracuse, N. Y.
Cleveland	Dec. 11	Cleveland Engineering and Scientific Center	7:45	Quality Assurance for Home Products	Colston Warne, president, Consumers Union, Amherst College, Amherst, N. H.
Columbus	Dec. 10	Battelle Memorial Institute	8:00	Reliability Engineering (Joint meeting ASME)	George A. Henderson, Reliability Branch, Redstone Arsenal
	Dec. 15	Deshler Hotel	8:00	Control Charts in Industrial Engineering (Joint meeting AIIE)	Joseph Moyshin, QC Consultant, St. Louis, Mo.
Dallas-Fort Worth	Dec. 10	Tour of TEMCO Aircraft, Grand Prairie, Tex.	7:00	A Reliability Training Program for a Missile Weapon System	Carl Schwalm, TEMCO Aircraft Corp., Grand Prairie, Tex.
Delaware	Dec. 4			Random Balance	Franklin E. Satterthwaite, Merrimack College, North Andover, Mass.
Evansville-Owensboro	Dec. 15	Green River Steel Corp., Owensboro, Ky.	7:30	Plant Tour	
Grand Rapids	Dec. 10	———	——	Dinner and Social Evening	———
Greater Detroit	Dec. 9	Veterans' Memorial Bldg., Detroit, Mich.	——	How QC Programs Reduce Plant Operating Costs	Robert Vujovich, Chrysler Corp., Detroit
Greater Muskegon	Dec. 10	Bill Stern's Restaurant	6:30	QC at Zenith Radio Corp.	Emery Gotchall, Zenith Radio Corp., Chicago, Ill.
Hamilton	Dec. 3	Firestone Tire & Rubber Co., Hamilton, Ont.	8:00	Plant Tour	———
Hamilton-Middletown	Dec. 9	Plaza Motel Restaurant	6:30	Planning and Engineering Prerequisite to QC Success	James M. Barrabee, Hoover Ball and Bearing, Ann Arbor, Mich.
Harrisburg	Dec. 2	Yorktowne Hotel, York, Pa.	6:30	Who Establishes Spec Limits	Panel Discussion
Hartford, Conn.	Dec. 15	To be announced	——	Metrology	Joseph L. Boister, General Electric Co., Pittsfield, Mass.
				Setting Up a Metrology Dept. and a Gage Control Program	William McCallum
Kankakee-Joliet	Dec. 7	Maple Manor, Kankakee, Ill.	7:00	Sequential Sampling by Variables	Nicholas Relich, Purdue University, Lafayette, Ind.
Lexington	Dec. 4	IBM Corp.	7:00	The Cutting Edge (Joint meeting with ASTE)	Film by DoALL Co.
Indianapolis	Dec. 8	Athenaeum Turners Club	6:30	Human Engineering	Archie Burgess, Texas A & M, College Station, Tex.
	Dec. 15	Holcomb House, Butler University	7:30	General Committee Meeting	———
Lima	Dec. 8	Sylvania Corp., Ottawa, Ohio	8:00	How to Make an Investigation	Stephan J. Adams, Wolverine Tube Co., Detroit, Mich.
Los Angeles	Dec. 8	Carolina Pines Restaurant	6:00	The B-58 Reliability Program	J. L. Coburn, Convair, Fort Worth, Tex.
Louisville	Dec. 14	Falls City Brewery, Louisville, Ky.	8:00	Plant Tour of the Brewery	———
Metropolitan	Dec. 4, 5	Princeton University, Princeton, N. J.		Princeton QC Conference	
Mid-Hudson	Dec. 1	The Anchor Inn, Poughkeepsie, N. Y.	7:00	Quality Reports to Management	James R. Gilman, Bay State Abrasive, Westboro, Mass.
Milwaukee	Dec. 14	Stratford Hotel, Ladies Night	6:00	QC As a Profession	A. H. Benscoter, A. O. Smith Corp., Kankakee, Ill.
Montreal	Dec. 16	CIL Bldg.	8:15	Multilever Continuous Sampling	D. C. Flischel, General Electric Co., Cincinnati, Ohio
Parkersburg	Dec. 9	———	——	QC in the Food Industry	Robert N. Johnson, The Kroger Co., Cincinnati, Ohio
Pensacola-Mobile	Dec. 15	Martines, Pensacola, Fla.	6:30	Defect Per Unit Multi-Level Continuous Sampling	J. W. Comish, Brookley AFB, Ala.
Philadelphia	Dec. 19	Germantown Cricket Club	7:00	Social Evening	To Be Announced
Pittsfield	Dec. 9	Stanley Club	6:45	Design of Experiments	M. E. Terry, Bell Telephone Laboratories
Portland	Dec. 1	———	7:30	Polaris Missile Reliability	W. L. Hurd Jr., Lockheed Missile Space Division, Sunnydale, Calif.
St. Charles	Dec. 15	Club Arcadia, St. Charles, Ill.	4:30	Panel Discussion: Control of Opinion in Quality Control	Moderator: James L. Morrissey, Knowles Electronics, Franklin Park, Ill.
St. Louis	Dec. 11	Golden Fried Chicken Loaf Restaurant	6:00	Texas Foundaries Quality Improvement Program Joint meeting, American Foundrymen's Society	B. M. Appleman, Texas Foundaries, Inc., Lufkin, Tex.
San Antonio	Nov. 24	Hilton Hotel	7:00	Blueprint Measurement Repeatability	Jack Gantt, General Electric Co., Cincinnati, Ohio
San Diego	Dec. 14	Lafayette Hotel	——	Project QC Test Planning	A. C. McMaster, Convair-Pomona, Calif.
Toledo	Dec. 12	Secor Hotel	6:30	Annual Christmas Party	———
Toronto	Dec. 2	University of Toronto	7:30	Tests for Significance	M. J. O'Callaghan, B. A. Oil Co., Ltd., Toronto
Western Massachusetts	Dec. 8	Shelton Hotel, Springfield, Mass.	6:30	The QC Manager as an Executive	Robert Mitchell, International Latex Corp., Dover, Del.
University of Western Ontario	Dec. 9	YMCA, Stratford, Ont., Canada	8:00	Panel Discussion and Case Histories	Moderator: J. E. Crossman, Raytheon Canada Ltd., Kitchener, Ont.
Winnebago	Dec. 14	Elks Club, Appleton	5:30	Management of the Statistical Function in Industry. Joint meeting with the Society for the Advancement of Management.	A. F. Johnson, Buckeye Cellulose Corp., Memphis, Tenn.
Worcester	Dec. 9	Nick's Grille	7:00	QC in the Metals Industry	John F. Occasione, Am. Steel & Wire Div., U. S. Steel Corp., Cleveland, Ohio

clinics, conferences, and courses

DECEMBER

. . . **1-3**—1959 Eastern Joint Computer Conference, Statler Hilton Hotel, Boston, sponsored by the IRE, ACM, and AEE, contact the Registration Committee, P. O. Box 5, Needham 94, Massachusetts.

. . . ***4—One day conference on Random Balance. Speaker, Frank Satterthwaite, originator of the technique. If any of your nonmember friends wish to attend, please notify the Delaware section so an invitation may be issued. Contact Thomas J. Hahn, conference chairman, International Latex Corp., Dover, Del.***

. . . ***4-5—Princeton-Metropolitan Conference, contact Frank Kroll, Esso Standard Oil, Box 222, Linden, N. J.***

. . . **9—1959** Annual Meeting and Standards Council Meeting, American Standards Association, Plaza Hotel, Fifth Avenue and 59th Street, New York, N. Y.

. . . ***26-31***—126th American Association for the Advancement of Science, Hotel Morrison, Chicago, Ill., contact the Engineers Joint Council, 29 West 39th St., New York 18, N. Y.

JANUARY

. . . ***11-13—Sixth National Symposium on Reliability and QC, Hotel Statler, Washington, D. C., contact I. W. Schooninger, Centralab Div., Globe Union, Milwaukee, Wis.***

. . . ***11-15***—Society of Automotive Engineers meeting, Detroit, Mich.

. . . **25-Feb. 4**—**The 1960 Engineering and Management course for the professional development of managers and engineers will offer a choice of 22 subjects at the University of California, Los Angeles. Information on registration and living accommodations may be obtained from Reno R. Cole, College of Engineering, University of California, Los Angeles 24, Calif.**

FEBRUARY

. . . ***1-11***—The thirteenth annual short course in QC by Statistical Methods, Mechanical Engineering Dept., University of Illinois, with the cooperation of the Division of Engineering Extension at Urbana, contact Robert K. Newton, supervisor, Engineering Extension, 116 D Illini Hall, Champaign, Ill.

. . . ***1-5***—Instrument Society of America meeting, Houston, Tex.

. . . ***5-6***—Industrial Management Engineering Conference with a section in QC, contact LeRoy A. Wickstrom, conference director, Department of Industrial Engineering, Illinois Institute of Technology, Chicago 16, Ill.

. . . ***18-20—Tenth Annual Textile Division Conference, Clemson House Hotel, Clemson, S. C., contact Robert E. Heiland, Rt. 1, Coopersburg, Pa.***

. . . ***27-28—District 3 Conference, Hotel Statler, N.Y. City, contact Edwin Shecter, Sonotone Corp., Elmsford, N. Y.***

APRIL

. . . ***18-19***—Third Annual Conference on Automatic Techniques, sponsored jointly by ASME, IRE, and AIEE, at the Cleveland-Sheraton Hotel, Cleveland, Ohio, contact the Publicity Chairman, Room 530, 1213 W. 3rd St., Cleveland 13, Ohio.

MAY

. . . ***16-18***—Symposium on Statistical Methods in the Pulp and Paper Industry sponsored by the Finnish Paper Engineers' Association in Helsinki, contact Nils J. Lindberg, general secretary of the symposium, the Finnish Paper Mills Association, Helsinki, Finland.

. . . ***24-26—14th Annual Convention and Exhibition of the American Society for Quality Control, Hotel Sheraton-Palace, San Francisco, Calif.***

. . . ***30-31, June 1—Mid-Pacific Conference, Honolulu.***

ASQC Annual Convention Future Dates

May 24-26, 1960	***San Francisco***
May 22-24, 1961	***Philadelphia***
May 23-25, 1962	***Cincinnati***
May 20-22, 1963	***Chicago***
May 26-28, 1964	***Buffalo***

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